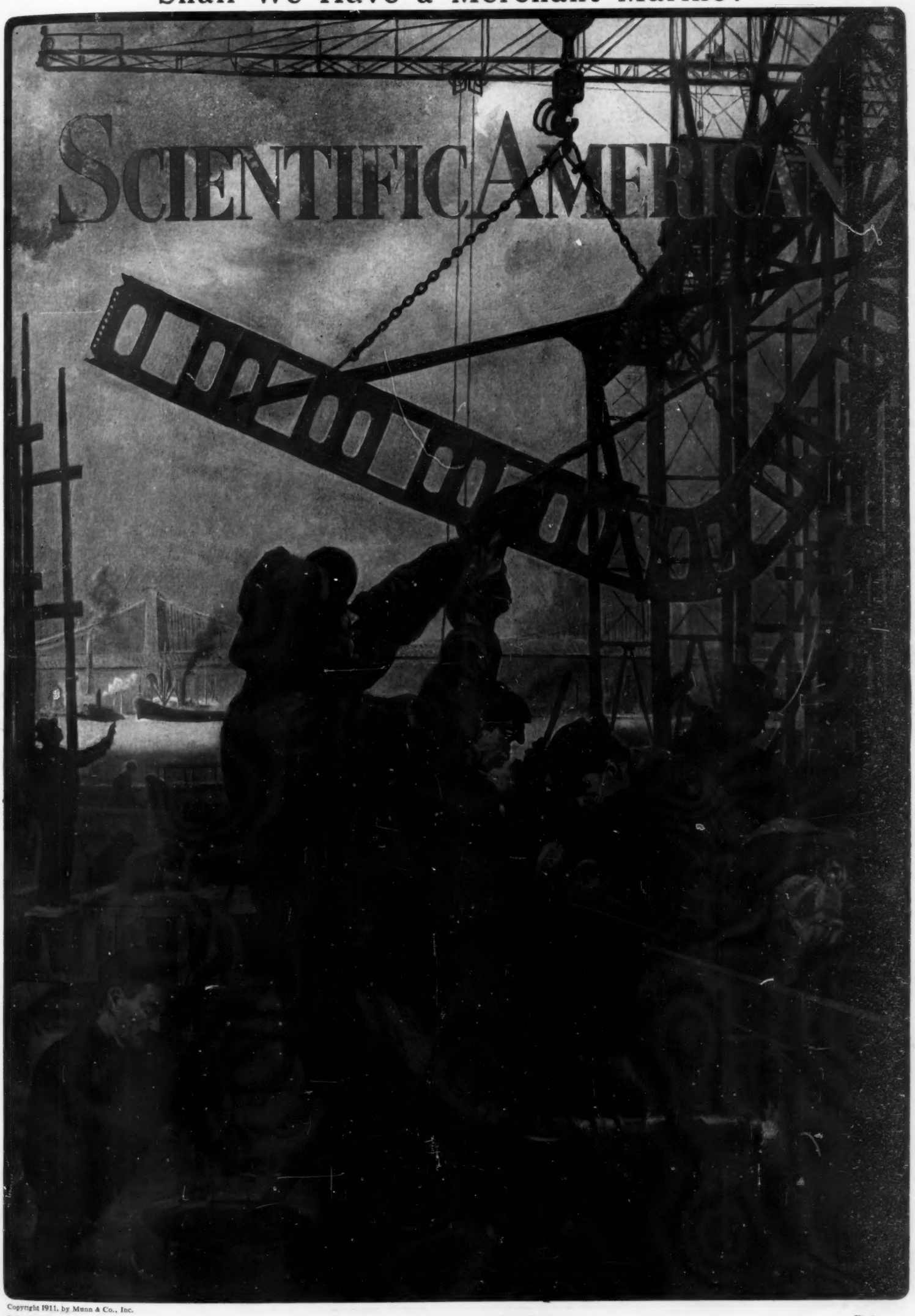
Shall We Have a Merchant Marine?



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Launch equipped with searchlight and G. E. Mazda Lamps

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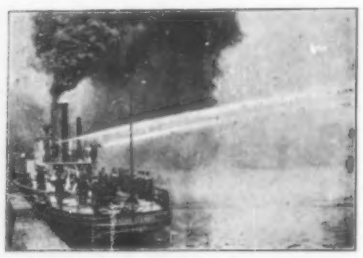

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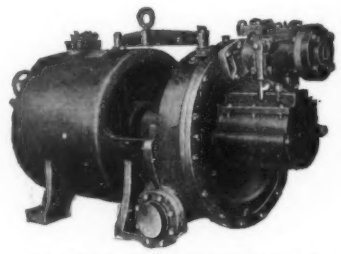
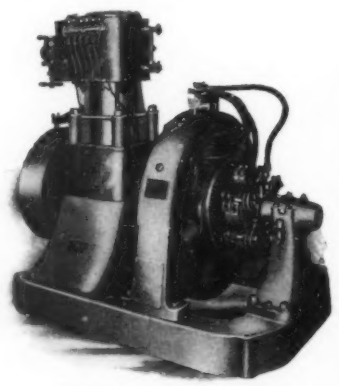


Steam turbo-generator for direct connection to boiler



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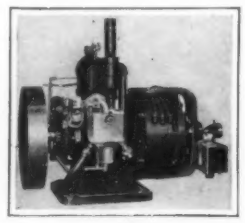

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SCIENTIFIC AMERICAN

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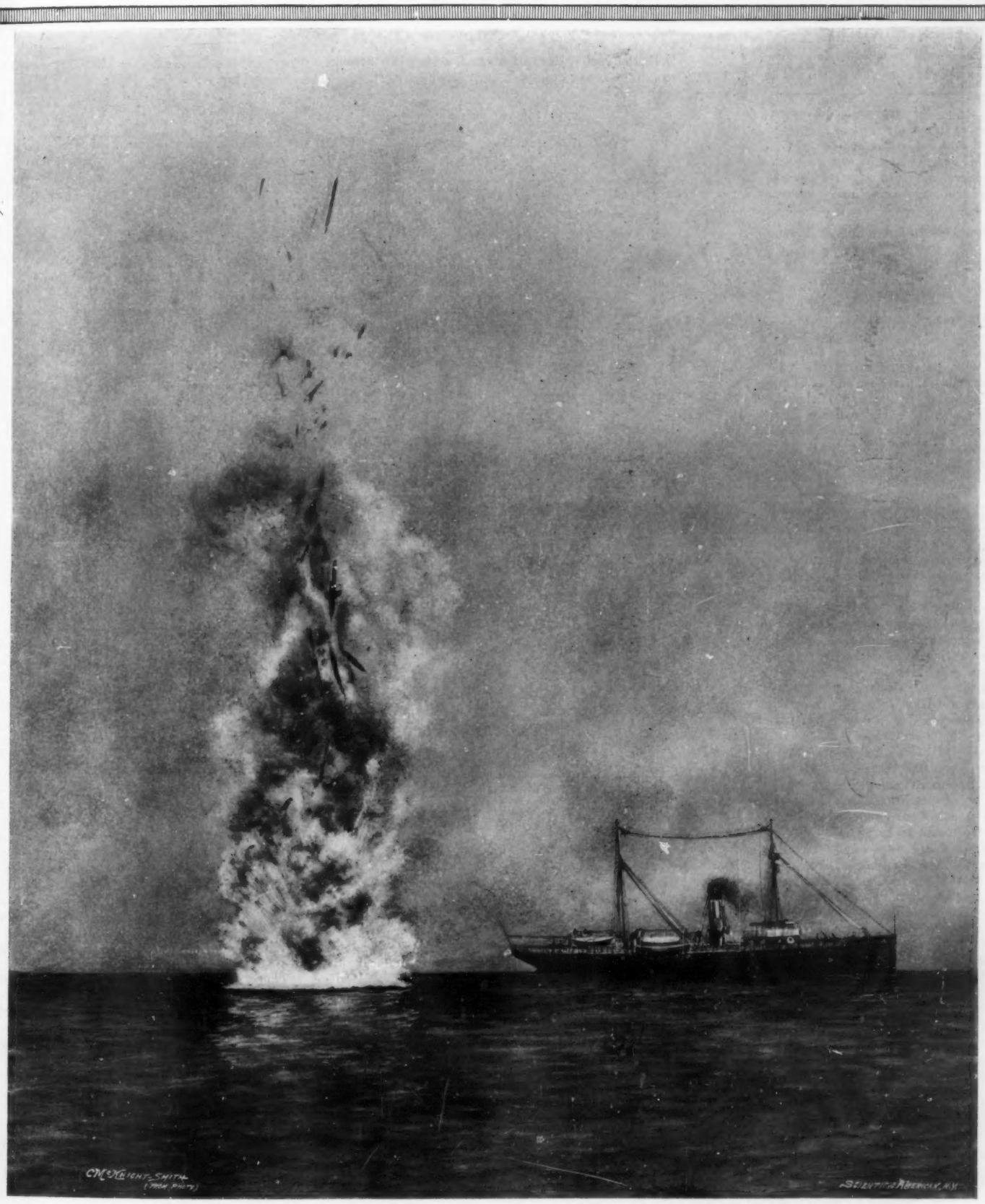

The derelict destroyer "Seneca," of the Revenue Cutter Service, built especially for finding and destroying derelicts and floating wreckage, and assisting disabled vessels. **—[See page 51]**

CLEARING THE OCEAN HIGHWAY

SCIENTIFIC AMERICAN

Founded 1845

NEW YORK, SATURDAY, JULY 15, 1911

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Munn & Co., Inc., 361 Broadway, New York

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately and in simple terms, the world's progress in scientific knowledge and industrial achievement. It seeks to present this information in a form so readable and readily understood, as to set forth and emphasize the inherent charm and fascination of science.

Montauk as an Atlantic Terminus

DURING the past few months, much has been published in the daily press about the proposal to build at Montauk, on the eastern end of Long Island, a large terminal harbor for the use of trans-Atlantic passenger steamers. The avowed object of doing this is to shorten the Atlantic passage and save two or three hours of time. The distance from Montauk to New York by rail is about 120 miles, and it is proposed that the steamships enter the new harbor and transfer their passengers to special railway trains, which in two or three hours' time would land them at the new Pennsylvania station in the heart of Manhattan Island, thus saving a few hours over the steamship route.

It is probable that the recent propaganda is the joint work of the railroad company which controls the Long Island Railway system and certain of the steamship companies which are seeking permission of the government to lengthen the North River piers to accommodate the great length of their latest vessels. As far as the steamship companies are concerned, it is no doubt their belief that if the business interests of New York could be brought to believe that the construction of a Montauk terminus was being seriously undertaken, they would unite in an application for longer piers, so earnest and unanimous, that the desired government permission would be granted.

Now, although the SCIENTIFIC AMERICAN is an earnest advocate of pier extension, we do not believe that favorable action on the part of the federal government will be brought about, or even assisted, by such a palpable "bluff" as this talk about transferring the trans-Atlantic terminal from this city to a remote spot on the sparsely settled coast of the eastern end of Long Island. For the astute men of the engineer corps of the United States army are too well versed in those fundamental principles which govern the selection of terminal ports to be deceived by the arguments set forth. It is in accordance with those principles that New York is to-day the leading port for trans-Atlantic passenger travel; and, if reasonable enterprise is shown in providing adequate facilities, New York must ever remain the leading port.

Furthermore, if the geographical and other demands which have given New York its predominance were ignored, and a port were formed at Montauk, it is very doubtful if all the wealth and influence of the railroads and steamship companies combined could divert travel from the present to the proposed harbor.

No one doubts that it would be possible to build at Montauk a magnificent and ideal terminal for Atlantic steamships. It is easy of access; provides ample depth of water for the largest vessels; and in the matter of piers, pier sheds, railway facilities, and all the et cetera of a point of transfer from ocean to railway, it could be made the most perfect work of its kind. But when the harbor was completed, it is very doubtful if the traveling public would appreciate the supposed advantages thus provided.

The fastest of our modern liners, the "Mauretania," has crossed the Atlantic at an average speed of 26 knots, or over 30 miles an hour, and at this speed she would cover the 120 miles to New York in four hours' time. If, instead of proceeding to New York, she entered Montauk Harbor, and transferred her passengers to special trains, they would take at least two and a half hours to make the run to Manhattan. It is true that some hours would be consumed by the "Mauretania" at quarantine, and in steaming up the harbor to her pier in the North River; but there would be a similar delay at Montauk for quarantine and in warping the big ship to her berth for the discharge of the passengers. The ultimate gain in time would be possibly an hour and certainly not over two hours; and as an offset against this would be the inconvenience to the passengers of an extra transfer—that from the steamer to the train—an objection so serious that it would probably prove a source of very material loss in passengers to any steamship line that made use of Montauk as a terminal.

In the earlier days of ocean travel, when accommodations were cramped, and the ships were small and of slow speed, the shortening of the voyage by a few hours would have been a matter of some importance; but in these days of giant vessels, whose bulk is so great that they are steady in any but the heaviest seas, and whose accommodations are such that the traveler is surrounded with all the conveniences which he has come to look upon as essential to his daily comfort, the matter of two or three hours more or less on board ship is one to which he is supremely indifferent. Certainly he would not wish to exchange the spacious dining saloons, lounges and smoking rooms of an ocean liner for the relatively cramped and uncomfortable accommodations of a modern railroad train.

But there are even weightier considerations, largely of a geographical character, which show the futility of the attempt to artificially create a trans-Atlantic terminus, 120 miles distant from the commercial metropolis which it would be intended to serve. The selection of the site for the great ports of the world has not been determined either by caprice or accident. The existence of the magnificent New York Harbor at the point where that great natural line of travel from the west to the Atlantic seaboard by way of the Great Lakes, the Mohawk Valley, and the Hudson River, reaches the Atlantic coast, determined beyond any chance of later revision where the principal meeting point of rail and ocean traffic would be found. The phenomenal growth of New York in population, trade and wealth was rendered inevitable by its splendid strategic position. The hundreds of miles of foreshore, the vast wharf and other terminal facilities (inadequate and capable of much improvement though they may be), the existence here of the terminals of the great railroad systems, the concentration here of the thousand and one trades and industries that cater to the ocean steamship, and finally the fact that within a few minutes of the landing wharfs are to be found the finest hotels in the country, and theatres and places of amusement by the score,—all these considerations, in addition to those of the inconvenience of transfer above mentioned, conspire to render the position of New York as the point of departure and arrival of Atlantic steamships forever permanent and unassailable.

Artificially Induced Mutations

IN the course of his work in elaboration of his theory of evolution through mutation, DeVries made the suggestion that alterations in the hereditary properties of organisms are due to changes in the germ plasm occurring before fertilization. In order to test the possibility of localizing such supposed changes, Dr. D. T. MacDougal (director of the Department of Botanical Research of the Carnegie Institution of Washington) started some far-reaching experiments about six years ago. Some of his general results have been referred to from time to time, but there has not until now been a complete account of what was done. This now appears in the *Botanical Gazette*.

A number of workers have attempted to obtain a modification of the developing embryo by placing the cut ends of flower stalks in various solutions, or by applying various solutions to the growing plant, but all results were negative. MacDougal adopted the plan of injecting the solutions into the ovaries of the plants just before fertilization was to take place. He used in his earlier experiments specimens of *Raimannia odorata* and *Oenothera biennis* which had been cultivated for several generations in pure cultures, where they showed no more differences than the ordinary fluctuating variations. The solutions used were various strengths of sugar, zinc sulphate and calcium nitrate in distilled water. The solutions were introduced into the ovaries by means of an ordinary hypodermic syringe. The first result of the operation was the casting off of the developing ovary in most cases. But some of the seed ripened in both species.

All the seedlings of the derived *Raimannia*, although ovaries from the three different treatments were represented, presented the same appearance—and that was different from the parental type. This evening primrose is a biennial: the derived individuals all ripened their seed during the first season. This involves not only the physiological character of whatever is concerned in early flowering, but the growth habit of the plant was entirely different from that of the parent. The *Raimannia* produces rosettes of leaves during the first year, the stem remaining very short; during the second season the stem elongates very rapidly, bearing leaves and flowers. Another difference between the original type and the induced derivative is perhaps even more striking. All the plants of this family regularly bear hairs on the skin of the leaves and stem. In the derived individuals the skin was quite free from hairs.

The results with the *Oenothera* were equally definite and were distinguishable from the very first. The cotyledons of the new plant are broader and of a brighter green than those of the original and the same is true of the leaves of the rosette. The plants have been cultivated for five generations and retain their new characters without any indication of a tendency to revert to the parent type. Specimens have been grown in different localities together with the parent form, and the differences remain constant.

The derivative of *Oenothera biennis* was hybridized with the parent form and resulted in a plant bearing intermediate characters, but being more vigorous in growth than either parent. The indications are that the derived *Oenothera* is a distinct type related to the parent but not intergrading with it.

Since 1906 over twenty species of plants chiefly desert forms, were experimented with. Although the fatalities among the experimental plants were high, owing to the action of ground squirrels, birds and other enemies, as well as to the results of the operations, a number of seeds were saved and grown. In a species of *Pentstemon* native to Arizona there appeared to be induced a new type as a result of the treatment of the ovaries, but whether the characters displayed by the derived individuals are really new to the species cannot be known with certainty since it has been impossible so far to obtain a pedigreed culture under control conditions.

The question of how the introduced solutions modify the reproductive cells cannot of course be answered by these experiments. In order to throw some light on this question, flowers of the giant cactus were used, with solutions containing methyl blue, and other flowers, with other pigments. On examining the flowers on the day after the injection of the dye, it was found that the solution had been absorbed in varying degrees by the different tissues of the ovary and ovules; but in no case had the pigment penetrated to the embryo-sacs. In the flower of the cactus the distribution of the methyl blue was such that the pollen tubes growing down into the ovary were affected. It would appear therefore that whatever effect may be produced by the solutions introduced into the ovaries is upon the pollen element rather than upon the embryo-sac nucleus. But the real nature of the changes produced is still unknown. It is impossible to observe the direct action of the reagents used upon the cell elements; this may be chemical, or it may be physical.

There are at present under observation seedlings from treated ovaries of about a dozen species of plants. While it is not yet possible to induce a desired mutation at will, these experiments will no doubt lead to results that will be of lasting practical as well as theoretical value.

Substitute for Platinum

IT has been suggested that, in the prevailing scarcity of platinum, the metal palladium might be a practicable substitute. It belongs to the platinum group, and has many of the qualities of platinum, although in some respects it resembles silver. Among its valuable characteristics are hardness, ductility and malleability. It is also decidedly non-corrodible. It occurs, along with nickel, copper, silver, gold, platinum, iridium and rhodium, in the ores of the Canadian nickel mines in Ontario. Out of 300,000 tons of these ores about 3,000 ounces of palladium are annually produced.

The Upbuilding of Our Merchant Marine

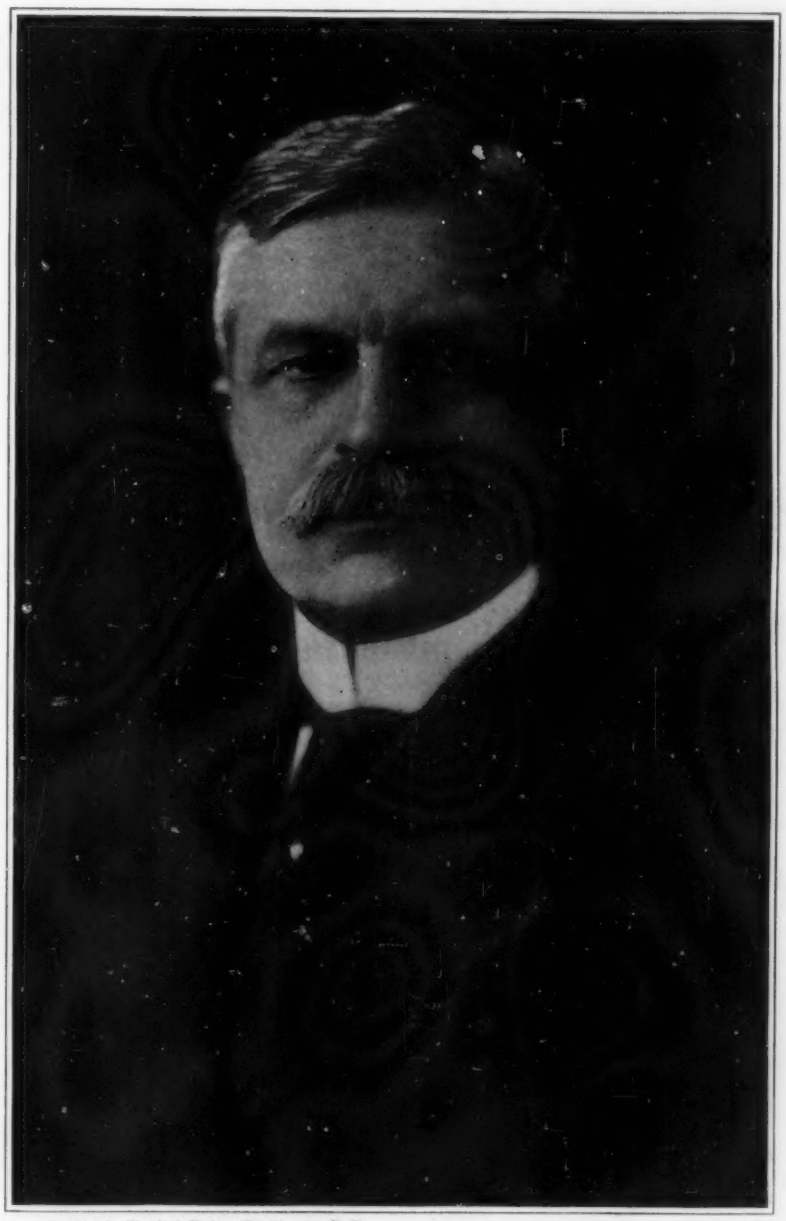
Our Extensive Foreign Trade and the Near Completion of the Panama Canal Call for Immediate Action

By the Hon. Charles Nagel, Secretary of the Department of Commerce and Labor

THE subject of the merchant marine has been discussed so exhaustively that the sole remaining question seems to be one of ways and means. No one doubts that our merchant marine should in some manner be restored. Our coast line is so extensive, and the success of its marine service is so great, that the suggestion for an ocean marine is constantly kept before us. The marine service upon the lakes and along our coast emphasizes the absence of an ocean marine and strengthens the demand for legislative aid to foreign trade across the oceans.

This situation is accentuated by the fact that the Panama Canal is nearing completion. As it appears now, all the countries that control a merchant marine will be in a position at once to make use of this new maritime route. Our country, however, has taken no steps to the same end, but on the contrary our strength is dissipated in discussions about ways and means by which the merchant marine might be restored. It looks to me that this delay may have serious consequences. We not only lose the immediate opportunity and profit; but routes once established and connections made by foreign trade are not easily dislodged. If our country wants to get the full benefit of this newly-created opportunity, with all it implies, we should be prepared at the inception to take full advantage of this route, established by our enterprise and with our money.

The country which is first upon the ground with its goods has an undoubted advantage; and the country that sends its goods in its own bottoms at once gives the highest possible guaranty of its determination to maintain its trade. In my judgment, one of the great advantages, if not the greatest, in having our own merchant marine, rests right at this point. It is not only a question of profitable investment, and of the employment of money and men; but it is a question whether we shall give foreign countries with whom we propose to establish and maintain trade a guaranty of our good faith and continued purpose. Neither government nor business is determined by material interests alone. Impressions and sentiment are not to be disregarded. Foreign countries with whom we seek to establish intimate commercial relations will not be convinced of the earnestness of our purpose, until our country is prepared to have its consignments come into foreign harbors under our flag, to be delivered from our decks. Such a pledge of our determination to sustain lasting relations would be accepted above all others.



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HON. CHARLES NAGEL

Secretary of the Department of Commerce and Labor.

Again, it is often said that foreign ships plying between our ports and foreign ports provide ample facilities for all our foreign commerce. Superficially speaking, that may be true. There may be ships enough to accommodate all the trade between all the countries in question. But granting this to be true, in my judgment the real situation is not met. These foreign ships sustain no commercial or administrative relation to our country. They do sustain, as a rule, the closest possible relation to the countries in which they are owned. I am not now speaking of the financial support, be it subsidy or something else; but I am speaking of the power which foreign countries exercise by way of making rates for purposes of successful competition on their part. It goes without saying that our commercial competitors everywhere sustain a much closer relation to their governments than probably would be possible under our political institutions. In foreign countries commerce has the immediate encouragement of government, participates in deliberations which go to the development of that commerce, and finds encouragement by way of protection of one kind or another. The same thing is true of the carriers. Rates are made to meet the demands of the situation; and it goes without saying that we do not enjoy exceptional rates when we undertake to compete with the commerce of those countries in which the ocean carriers are owned and controlled. We have adopted a policy of equal rates for all shippers, and that rule is now pretty fairly enforced. We are therefore compelling our trade, under a regulation of this kind, to compete with the commerce of foreign countries in which the same rule is not enforced. It appears to me to stand to reason that we are therefore not in a position to compete upon equal terms. We are compelled to depend upon carriers who are beyond our control, but who are free to respond to the demands of foreign trade when it is in competition with us.

The situation is difficult enough with respect to our commercial organizations, upon whom we depend to introduce our trade into foreign countries. We do not tolerate combinations in this country, whereas like organizations engaged in competition with us in foreign countries are systematically sustained. This, of course, is an unavoidable condition—a price we may for the delayed reconstruction of our commercial forces. But it appears to me that such a condition should not be carried to an unnecessary length. We depend upon a foreign merchant marine, which may, and no doubt does, give preference to our competitors. We are confronted with the question of whether or not we can successfully complain even of a combination or a monopoly between all the foreign ocean carriers that enjoy the trade of our ports. It appears to me, therefore, to be high time to consider ways and means by which we may restore our own merchant marine, to serve us impartially in competition, and to respond to such regulations as our country through our Government may see fit to impose upon such an agency.

Of course I am aware that there are many other reasons that may be assigned for the restoration of a merchant marine. It is apparent that a navy such as we have ought to be supplemented by a merchant marine; and that without such aid in case of need the navy is necessarily in a measure handicapped. I prefer, however, to rest the case in favor of a merchant marine solely upon the commercial considerations, which to my mind are conclusive.

As to the means by which such a result is to be accomplished, I prefer to say nothing. I think the issue has frequently been confused by the cry of subsidy, and by the contention that other countries do not subsidize, and that, therefore, we ought to be able to restore our marine without such assistance. I think the facts show that in one way or another, most, if not all, countries which have a considerable merchant marine do give support. Be that as it may, we are dealing with a condition and not with a theory. We know that the enterprise of our country has challenged competition in nearly every field. We know that we are making progress in the extension of our foreign trade. We know that our lake and coastwise marine service is at least equal to that of any other country. We must conclude that the absence of an ocean marine must have some reason other than accident or a lack of initiative. If we are to compete successfully with foreign countries we must gage the instrumentalities which they employ. And if we are unwilling to resort to their methods, then it must at least be for us to ascertain what we can and must do to engage in successful competition. We cannot afford to rest upon our oars. The day has passed when we can expect things to come to us because we have vast resources and great natural wealth. The time has come when we must fight for our position in the field of commerce, and when we must take into account the means employed by others in determining what it is for us to do.

Measurements of Subterranean Temperature

THE deepest hole in the world, up to date, is the boring begun ten years ago at Czuchow, Silesia, with the object of attaining a depth of 2,500 meters, and which has now reached a depth of 2,240 meters (7,349 feet). The bore is 44 centimeters in diameter at the top, and diminishes progressively to 5 centimeters. Measurements of temperature have been made regularly. At 2,220 meters the temperature is 83.4 deg. C. (182 deg. F.). This gives a "geothermic degree" (amount of descent corresponding to a rise of temperature of 1 deg. C.) of 31.8 meters. The change of temperature does not proceed uniformly. In fact an interesting "temperature inversion" occurs between the depths of 640 and 730 meters, where the temperature actually falls, with descent, about 2 deg.

The American Merchant Marine

Analysis of the Causes Underlying the Amazing Growth and Rapid Decline of American Shipping

By the Hon. Eugene Tyler Chamberlain, Commissioner of the Bureau of Navigation

THE total tonnage of documented American shipping to-day—in round numbers 7,500,000 gross tons—is second only to the British total of 19,000,000 gross tons. On the Great Lakes alone we have 2,100 steamers of 2,500,000 tons, which in efficiency are unsurpassed, and in the aggregate are more than double the tonnage of Japan and greater than that of France. Indeed, the fleet on our inland seas ranks next in tonnage to the 4,300,000 tons under the German flag, which visit every port in the world. In view of these facts, the question may well be asked: What signifies discussion in and out of Congress on the decadence of the American merchant marine? The answer is to be found in the fact that barely one-tenth of our tonnage is registered for the foreign trade, and that at the present time less than 500,000 tons are so engaged. In oversea competitive navigation we barely hold the eighth place, and the absence of our flag in foreign ports is the subject of pertinent comment by travelers. Our ships carry less than nine per cent of our exports and imports. While the Congress has divided more or less on party lines over the choice between subsidies or free ships, practically every maritime nation except the United States has both systems and we have neither in effective form.

Two generations of men now living saw the time when the United States was pressing Great Britain close for the commercial mastery of the seas. The radical changes in our navigation have thus been effected within fifty years; but a cursory glance at simple gross tonnage figures may illustrate crudely the lines of our development in navigation. Expressed in thousands of tons (ton equals 100 cubic feet), the following table shows for important periods the tonnage of our merchant shipping, together with its three lines of occupation—the foreign trade, the domestic coasting trade, and the fisheries.

American Documented Tonnage.

	Foreign.	Domestic.	Fisheries.	Total.
1789....	124	68	9	201
1800....	667	272	33	972
1820....	584	588	108	1,280
1860....	2,379	2,645	329	5,353
1870....	1,449	2,638	159	4,246
1910....	782	6,669	57	7,508

Perhaps no other single thing better illustrates the courage and tenacity of purpose, the political and business prescience and the broad humanity which inspired the fathers of the republic than their early and persistent attack upon the system of discriminations in navigation devised by Oliver Cromwell and relentlessly followed by the advisers of the House of Hanover against the Americans whom two wars had failed to subjugate. "Those principles of liberal intercourse and of fair reciprocity which intertwine with the exchange of commerce the principles of justice and the feelings of mutual benevolence," as expressed by President J. Q. Adams in 1828, "were first proclaimed to the world in the first commercial treaty ever concluded by the United States in 1778 with France, and have been invariably the cherished policy of our Union." Our Presidents, from Washington to Taft, have consistently followed that policy, in which all parties have concurred. Mr. Adams added "whatever of regulation in our laws has ever been adopted unfavorable to the interest of any foreign nation has been essentially defensive and counteracting to similar regulations of theirs operating against us."

Up to 1820 the Federal statistical system was imperfect and inaccurate, so those figures in the table above must be taken with allowances. This period, too, embraces our own war of 1812 and the Napoleonic wars which disturbed commerce and embarrassed navigation. During this period 180,000 men were required to man England's navy, while only 140,000 were employed on her merchant fleets. England's absorption in war enabled the United States in the first part of the nineteenth century to begin to supplant her as the world's carrier.

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HON. EUGENE TYLER CHAMBERLAIN

Commissioner of the Bureau of Navigation.

The period of maritime reciprocity from 1820 to 1860 witnessed the greatest and most rounded development of American merchant shipping. In these forty years in both foreign and domestic trade our tonnage multiplied fourfold—a rate which has been surpassed for a corresponding interval only by the marvelous development of German shipping during our own day, inspired by Bismarck and sagaciously encouraged as a political as well as a commercial policy by the Imperial German Government. At the present rate of growth modern Japan perhaps may make even more rapid progress. The growth of those forty years was due to natural causes. The races of Northern Europe, with but a slight admixture of the Latin, combined to form the free population of the colonies which became the original States of the Union.

Bred to the sea and confined to a narrow seaboard, these men and their descendants found occupation and profit as well as outlet for the spirit of adventure in navigation to all quarters of the globe. Ships were built of wood and our illimitable forests furnished abundant material, while England's depleted timber lands compelled her to import from a distance materials for naval and merchant fleets. The discovery of gold in California opened to our navigation a new trade which was restricted by law to American vessels. But even during the period of its most rapid growth causes were at work to check American maritime progress and to promote the growth of British shipping. Of these the most influential was the increasing use of iron as the chief material of construction for ships' hulls. England's supply of iron was abundant, while our own supply was limited, and the advantage which the United States had enjoyed in its forests swung back to Britain and her mines of coal and iron. The Fulton Centenary is fresh in the minds of all, and one need barely allude to the fact that from the outset Americans were among the first to apply steam to navigation. Yet the substitution of the steamer for the clipper ship, for reasons inherent to the nature of our people, was as effective in checking our growth as the substitution of iron for wood. The nature of work and the kind of men to perform it on shipboard were revolutionized by this change. The full-rigged ship demanded of its officers and crew intelligence, skill and daring in the open air, and of its owner enterprise and more or less of the speculative spirit. In these Americans excelled. The greater part of the work on the steamer consists in shoveling coal deep down in the hold, and for this kind of work the American has no adaptability. Even if the drain of the civil war on the young men of the North had not made it necessary for Congress to repeal the law of many years' standing requiring two-thirds of the crews of American ships to be Americans, it is certain that such a change before 1870 would have been forced upon the statute books. For the steamer, too, England had the coal which we at the time were producing in limited quantities. She had the miners to serve as firemen and coal-passers on her steamers, while we were just beginning to dig on the surface of our mineral wealth.

The causes named would have sufficed to have put England far to the fore even if the civil war had not turned Americans aside from commercial competition with foreign nations to armed conflict with one another. In the table above between 1860 and 1870 our fleets in foreign trade and the whale fisheries lost 1,000,000 tons—almost the exact measure of American shipping transferred to foreign flags through dread of the "Florida," "Alabama" and the "Shenandoah," or actually captured as prizes or burned at sea by the Confederate privateers.

The policy of ocean mail subsidies adopted by England in 1840 and consistently followed since, has always stimulated the building of the highest types of steamships, and while the aim of the policy has been political the indirect benefits to British shipbuilding and navigation have been considerable. If Congress, at the close of the civil war, had passed a bill allowing our citizens to purchase steamers abroad and register them under the American flag for foreign trade, it is quite possible that the losses consequent upon the war would have been partly made up. To overwhelm the Confederacy required an immense number of sailors on our warships of all

descriptions, and these would have readily returned to merchant shipping. Five years, too, had not sufficed to turn our shipowners and shipbuilders from the sea to the land, nor had it destroyed their prestige in foreign ports. That course was not followed; on the contrary, an act was passed denying a return to the flag of any American vessel transferred to aliens "during the existence of the rebellion."

The first trans-continental railroad was completed in 1869 by the junction of the Union and Central Pacific railroads. From 1870 to the present time the railroad mileage of the United States has increased from 53,000 to nearly 250,000 miles. Without heaping up readily accessible figures these and the conclusions to be drawn from them suffice to show that after the war the capital and energies of the country were turned entirely toward internal development. Transportation by land, agriculture, manufactures, and mining absorbed all the capital and labor which formerly had been engaged in oversea shipping and many times more than those amounts. The bulk of our lake tonnage and much of our coastwise shipping is subsidiary to railroad and mining corporations. Even the Norwegian immigrants to the United States, sailors born, do not stop at our seaboard cities, but go west to the farms of Minnesota, the Dakotas, and already are moving thence into Manitoba and the remoter farm lands of Canada. The wealth and prosperity of the country as a whole and of individuals have undoubtedly been greater by this diversion than would have been possible by a persistent effort under adverse conditions to try to meet foreign competition on the ocean.

The table above shows that since 1870 we have virtually ceased to be a maritime commercial power competing with England, Germany, France and Japan, or even lesser commercial powers. Sixteen years ago we had a fleet of the four fastest and finest trans-Atlantic mail steamers, but these have long since been surpassed, and such trans-oceanic steamers as we have to-day owe their existence to the Ocean Mail Act of 1891, or to the anticipated passage of the subsidy bill of twelve years ago, identified with Senator Frye, former Senator Edmunds and the late Senator Hanna.

Vessels built in the United States and no others can engage in our domestic commerce. Foreign competition is cut off by prohibitory penalties. To this statute, dating from the early years of the republic, and to our naval shipbuilding programme, we owe the existence of such seaboard shipyards as we have to-day. On the lakes foreign competition is shut off by Niagara Falls and the limited capacity of the Welland Canal quite as effectually as by legislation. Since 1870 our shipping on the Great Lakes has increased from 685,000 tons to 2,890,000 tons, while in forty years our shipping in domestic commerce along the seaboard has increased from 1,950,000 tons to 3,780,000 tons, or scarcely doubled.

The figures of our own maritime growth of course are inconclusive unless we compare them with the growth of other maritime nations during the last century and during the first decade of the twentieth century. A somewhat different method of statistical statement is necessary to present accurately the facts for so long a period. The merchant fleets of 1800 comprised entirely sailing vessels, while those of the present time are made up almost exclusively of steamers. The steamer is a much more efficient carrier than the sailing vessel, for obvious reasons. In comparing the two types, the best authorities practically agree that at the present time the net tonnage of the steamer (net tonnage being the space available for cargo and passengers, excluding machinery, bunker coal, etc.) should be taken at four times the net tonnage of the sailing ship. The table below, in thousands of tons, gives Mulhall's figures for 1800, and on the basis just stated the potential tonnage of shipping for 1900 and 1910, computed from Lloyd's Register for the years specified.

Potential Tonnage.

	Mulhall.	Lloyd's Register.	
	1800.	1900.	1910.
British	1,856	31,917	44,795
American	970	5,420	12,107
German	150	5,868	10,040
French	250	2,468	3,780
Norwegian	70	3,935	4,031
Various	730	12,492	22,056
Total	4,026	62,100	96,809

The ships of England, Germany, France, Norway and most foreign powers sail the salt seas; more than half the American tonnage for 1910 in the table above traversed the improved channels and fresh water of the Great Lakes. In ten years the carrying capacity of the Great Lakes fleet has increased more than threefold.

In a few years the Panama Canal will probably be open to navigation. The trade by sea between the Atlantic and Pacific coasts of the United States is reserved to American vessels. If reasonable advantage be taken of our enormous expenditure in constructing the canal, its opening to commerce will result in a rapid increase in American shipping. Consistently with our treaties we are at liberty to provide that tolls on American merchant vessels passing through the canal either in domestic or foreign trade shall be paid from the treasury of the United States. There are ample precedents for such legislation in acts of Congress and in the legislation of other countries in respect of their navigation through the Suez Canal. It now seems probable that even before the opening of the canal the Congress may pass a law allowing ships built abroad to be registered in the United States exclusively for trade with foreign countries and with the Philippines. Ships have not been built for that purpose in the United States for some years, and the domestic shipbuilding industry would not be materially affected thereby, as of late American capital seeking investment in maritime enterprises has bought ships built abroad and sailed them under foreign flags. From such legislation the amount of anticipated benefit has been greatly exaggerated. The Gulf of Mexico and the Caribbean Sea are thronged with steamers owned by Americans, but sailing under foreign flags. Conditions of political unrest in Central American States, Venezuela, and recently in Mexico, have made it certain that were the opportunity offered, the owners of these fleets would seek American registry in order to secure at all times the protection of the flag. In trans-oceanic navigation, however, such considerations do not obtain, and it is difficult to find any satisfactory inducement for the transfer of a foreign-built ship to the American flag in the face of the higher wages which indisputably prevail on American ships.

It is a matter for profound regret that the United States has not carried to completion the ocean mail system undertaken twenty years ago. The reasons for the establishment of a complete ocean mail system are much stronger now than they were at that time. Alaska has been developed, we have acquired Hawaii, the Philippines and lesser islands on the Pacific, and Porto Rico on the Atlantic, and the highest statesmanship both here and in the republics to the south of us has interested itself in bringing about closer relations between the two Americas. Sooner or later the establishment of such a system is as inevitable as was the building of our new navy. Agitation for more than twenty years was needed to create a fleet of modern battleships, and an equal or longer time may elapse before an adequate ocean mail subsidy bill will be approved by Congress with certain results. Of England's mail subsidy system some years ago President Hadley of Yale College wrote:

"Its aims are political and not commercial. It is a necessity for England to have constant communication with her colonies, and she has spent large sums for this object. It is almost equally important for her to have an efficient naval reserve and transport service, and she has made her mail contracts one among several means toward this end."

These words apply with equal force to the necessities of the United States to-day. Free ships for foreign trade and subsidies are not alternative or conflicting propositions, but independent methods of dealing with two different subjects.

A Remarkable Ice Palace

THE use of ice for architectural purposes is an art that has been carried to a high state of perfection in northern countries, and some almost incredible feats have been accomplished in this curious branch of industry.

Probably the most remarkable building constructed wholly of ice was the palace built on the Neva by the Czarina Anne of Russia, in 1739. The first attempt to construct this building was unsuccessful, as the slabs of ice were too thin, and the building collapsed in the first thaw. Subsequently large blocks of ice were cut and squared with great care, and laid on one another by skilful masons, who cemented the joints with water, which immediately froze. The building, when completed, was fifty-six feet long, seventeen and a half broad, and twenty-one high. It was of but one story. The façade contained a door surmounted by an ornamental pediment, and six windows, the frames and panes of which were all of ice. An elaborate balustrade, adorned with statues, ran along the top of the façade, and another balustrade surrounded the building at the level of the ground. The side entrances to the inclosure were flanked with pillars supporting urns, the latter containing orange trees, whose branches, leaves and flowers were all of ice. Hollow pyramids of ice, on each side of the building, contained lights by night. The grounds were further adorned with a life-size figure of an elephant, with his mahout on his back. A stream of water was thrown from the elephant's trunk by day, and a flame of naphtha by night.

A tent of ice contained a hot bath, in which persons actually bathed. There were also several cannons and mortars of ice, which were loaded with bullets of ice and iron, and discharged.

The interior of the building was completely furnished, with tables, chairs, statues, looking-glasses, a clock, a complete tea-service, etc., all made of ice, and painted to imitate the real objects. A bed-chamber contained a state bed, with curtains, a dressing-table with a mirror, pillows, bed-clothes, slippers and night-caps—all made of ice. There were ice candles, burning naphtha; and, most wonderful of all, an ice fireplace contained burning ice logs!—i. e., blocks of ice smeared with naphtha and then kindled.

Wonders of Telephony

THE casual user of the 'phone who lifts off the receiver and talks to a friend miles away, has little idea of the wonders of telephony or of the labor necessary to maintain an up-to-date service.

The "telephone laboratory" is one of the busiest places in the world. It is here that the problems of telephony are worked out and means devised to improve and develop the system to meet future demands upon it.

Here any day one may see two experts in a room 15 or 20 feet wide and two or three times that length, talking with each other over circuits a thousand miles long. The equivalent of twenty miles of cable is contained in a box no bigger than an ordinary traveling bag, and 600 miles of pole line is represented by the contents of another box not as large as a dress suit case, while the entire apparatus at the central office, so far as it affects the individual subscriber's telephone line, is compressed into a couple of square feet.

With this equipment and two standardized telephone instruments, conversations over hundreds of miles are carried on within the four walls of this laboratory, one of the workshops of the central engineering force of the system.

Every detail of a long distance circuit from the subscriber's 'phone at one end of the line to that at the other end, with all the central office and overhead and underground construction that connects them, is reproduced with scientific exactness. By these means new devices and apparatus are tested, proposed improvements investigated, and the scientific theories involved in transmission and operation worked out. This may be done for the purpose of studying some minor bit of mechanism, of determining, for instance, the relative merits of two forms of the relay coils which automatically work the signals on the switchboard, or of learning the effect on a conversation of having one sort of equipment at one end of the line and another sort at the other end, or for any of a hundred other purposes.

Rules for Memorizing the Strength and Density of Concentrated Acids

THE following mnemonic rules, republished from the *Zeit. f. ang. Chemie*, have been given by E. H. Riesenfeld for the relation between percentage composition, specific gravity and concentration expressed in grammes per liter.

1. The per cent content of concentrated hydrochloric, nitric and sulphuric acids is equal to their molecular weight, while the concentration in gramme molecules per liter is equal to ten times their specific gravity. This is brought out in the following table:

Concentration.	Baumé, Deg.	Mol., Wt.	Content, Per Cent.	Sp. Gr.	Gm. Mols., Per Liter
HCl	23	36	37	1.2	12
HNO_3	40	63	63	1.4	14
H_2SO_4	66	98	98	1.8	18

2. The percentage of aqueous hydrochloric acid is equal to 200 times the difference between its specific gravity and that of water, or, in other words, $p = 200\ (s - 1)$. This relation is shown in the appended table:

Sp. Gr.	Content, Per Cent.	Sp. Gr.	Content Per Cent.
1.01	2	1.10	20
1.05	10	1.15	30

The Only Way to Restore the American Merchant Marine

Why Preferential Duties are Better than Free Ships or Subsidies

By the Hon. William Sulzer, Member of Congress

WE all realize that there is a sentiment, growing stronger and stronger every day, throughout the country, in favor of doing something to rehabilitate our merchant marine. This is patriotic, eminently proper, and should be encouraged by every true American. It is unfortunate, however, that many well-meaning citizens, who desire to see our ocean carrying trade restored to our own merchant marine, have little knowledge of the best way to do it, or of the causes which gradually drove our shipping from the high seas and placed us finally at the bottom of the list of the world's maritime powers.

There is no man in this country more anxious and more willing to enact proper legislation to restore the American merchant marine than myself, but I want to do it honestly; I want to do it along constitutional lines; and I want to do it in harmony with that fundamental principle of equal rights to all and special privileges to none.

It is a fact—a most deplorable fact—and every man who has investigated the subject knows it, that we have less registered tonnage for deep sea carrying trade to-day than we had 100 years ago. In 1810 the United States, with a population of less than 10,000,000 inhabitants, owned more registered tonnage for ocean carrying trade than the United States in 1910, with a population of over 90,000,000. The American deep sea tonnage in 1810 was over 1,200,000, and it is now less than 800,000, and what is worse still, it showed an actual decrease of more than 6,000 tons last year. In 1810 American ships, flying the American flag and manned by American sailors, carried over 90 per cent of our deep sea trade and a great part of that of all the countries of Europe. To-day we carry very little of our own trade, and practically none of other countries, notwithstanding the fact that we should be the foremost maritime power in the world.

It is a sad commentary on our growth and greatness that more than nine-tenths of our once great and powerful deep-sea fleet has vanished, and not one new keel for an ocean-going merchant ship is being laid to-day on either our Atlantic or Pacific coast, while the vessels of foreign nations throng our ports and monopolize more than nine-tenths of all our import and export commerce.

The question of the hour is how shall we restore the American merchant marine? What shall we do to place our flag again on every sea? What policy shall we adopt to regain our ocean carrying trade and revive our shipbuilding industry? There are several policies proposed by those who desire to restore the American flag to the high seas and secure for our country its proper share of the world's ocean commerce; and, briefly enumerated, they are as follows:

First—Ship subsidies.

Second—Free ships.

Third—Preferential duties.

Let me briefly discuss these proposed remedies in their order, stating as succinctly as I can, without prejudice, the merits and the demerits of each proposition; and I shall do so from a patriotic and not from a political point of view, because, in my judgment, the restoration of our merchant marine is purely an economic question based on patriotism, and rises superior to partisan considerations.

Let us come, then, to the first proposition, to wit, ship subsidies. In the light of the past, I think we can safely say that the American people are unalterably opposed to a ship subsidy raid on the Treasury. A subsidy is a bounty, a bonus, a gratuity, and it never has succeeded, and it never will succeed, in accomplishing the purpose desired. All history proves it conclusively. Wherever and whenever it has been tried it has failed. In my opinion, if a subsidy bill should pass it would not restore our American merchant marine or aid our shipbuilding industries. It is a waste of time to talk about ship subsidies. We might just as well pass a bill to pay a subsidy to every man who grows a bushel of wheat or raises a bale of cotton as to pay a subsidy to the man who builds a ship.

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HON. WILLIAM SULZER

Member of Congress. Author of the bill in Congress for preferential duties.

I am now, always have been, and always expect to be opposed to ship subsidies that rob the many for the benefit of the few. Ship subsidies do not build ships; they create ocean monopolies. Ship subsidies will not give workmen employment in American shipyards; the money taken without justification from the Treasury of the people will simply go to the men who own the ships now in commission.

Every scheme of this kind simply permits respectable corruption and benefits the few at the expense of the many. The principle of ship subsidies is inherently wrong, absolutely indefensible, and no man who understands the question can justify the policy in the face of the facts.

The taxpayers of our country, burdened now almost beyond endurance, are opposed to ship subsidies. They are opposed to any gift bill. They say no private business should be aided by direct grants from the Treasury. Ship subsidies are subversive of the eternal principles of equality, contrary to the theory of our institutions, of doubtful expediency, and at war with the spirit of the Constitution. Congress has no power to subsidize any trade, on land or sea, at the expense of the taxpayers of our country. Any attempt to fasten this odious system of ship subsidies on the legislative policy of the country is undemocratic, unrepublican, and un-American.

And now let us discuss the second remedy, to wit, free ships, by which I mean the right of an American citizen to build or buy a ship anywhere, give it the benefit of the American registry laws, and place upon it the American flag. To bring this about, all that is necessary to do is to repeal the prohibitive law, which is a blot on our common sense and a disgrace to our maritime intelligence; but this will never be done while the believers in protection for the sake of protection can prevent it, because they know it would be a death blow to their sacred doctrine. This policy of free ships has been advocated for years by many able and patriotic men who thoroughly understand this shipping question and deplore the loss we are sustaining every year by reason of the elimination of our merchant marine.

What a spectacle is presented when we realize that by virtue of our existing navigation laws the American who builds or buys a ship in a foreign country is an outlaw—prevented from giving the vessel American registration and compelled to sail the ship under the protection of a foreign flag.

There are, of course, several other objections urged against free ships, but I shall not go into details now and discuss them because I believe it will be impossible to pass a free ship bill at present through the Congress of the United States.

Now let us take up the third proposition, namely, preferential duties in favor of American-built ships and against ships flying the flag of a foreign country. My bill introduced in the congress provides for this, and I hope to see it pass ere this Congress finally adjourns. This was the policy so successfully in operation in this country up to 1828, when, to please foreign interests, the law was suspended, and from that day to this our prestige on the high seas has been declining until it is less to-day than it was a century ago.

The true friends of our merchant marine believe that if this policy of the fathers was restored it would revive our oversea carrying trade, and in a very few years build up our ship industries so that we would again secure our share of the ocean commerce of the world and save millions and millions of dollars that we pay annually to foreign shipowners. In reading the report of the Merchant Marine Commission, I observe that several of the largest shipbuilders testified that they formerly believed in subsidies, but had changed their opinions and now advocated preferential duties.

There seems to be but one objection, so far as I can learn, to a return to preferential duties, and this objection comes from the advocates of ship subsidies, who declare that we have commercial treaties with foreign governments containing the favored-nation clause, and in order to inaugurate the policy of preferential duties it will be necessary to change our commercial treaties, and this cannot be done without giving these favored nations one year's notice.

This objection, however, is more apparent than real, for there is no doubt the change could be made if this Government wanted to make it, and a year's notice to bring it about would cause no great delay, especially when we consider that nothing has been done for our deep sea shipping in more than a quarter of a century.

If we desire to change our commercial treaties with these favored nations, we have a perfect right to do so, and no nation can object. If there be retaliation, two can play at the same game, and our trade is more important to other nations than their trade is to our country. As I have said, many citizens and several distinguished members of Congress who have given this subject much thought and consideration believe that preferential duties will effectually solve the problem in the most feasible and practicable way.

It is my candid opinion, and I have no hesitancy in saying so, that if we had continued the policy of the fathers, and not suspended our early preferential duty laws, we would to-day be the greatest maritime nation in the world, and our flag would be on every sea and our ships would be carrying the commerce not alone of our own country, but perhaps half of that of all the other great nations of the world.

In this Congress I have again introduced my bill for preferential duties. It is a short bill and reads as follows:

A BILL

TO ENCOURAGE THE MERCHANT MARINE AND AMERICAN COMMERCE, AND FOR OTHER PURPOSES.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That a reduction of the duty of five per centum ad valorem of all of the customs duties now or hereafter imposed by law shall be allowed on all goods, wares, and merchandise imported into the United States in vessels of the United States. The said reduction in duty herein provided for shall not apply to goods, wares, and merchandise not of the growth, production, or manufacture of countries contiguous to or bordering upon the territory of the United States, when imported into the United States by land transportation or land vehicles or conveyances through or from ports or other places of countries bordering upon the United States, if the same shall have been brought to such ports in vessels not of the United States. And said reduction of duty shall not apply to all cases where goods, wares, or merchandise are transshipped or transferred from a foreign vessel, port, or place to a vessel of the United States for the purpose of evading the provisions of this Act.

SEC. 2. That the master, agent, or owner of any registered vessel of the United States shall be exempt from the tax of four dollars for every alien entering the United States on such vessel prescribed by section one of the Act of February twentieth, nineteen hundred and seven, entitled "An Act to regulate the immigration of aliens into the United States."

SEC. 3. That the President shall have power, and it shall be his duty, to give notice, within ten days after the passage of this Act, to all foreign countries with which commercial agreements have been entered into making any provision or provisions which are in conflict with sections one or two of this Act of the intention of the United States to terminate such agreement at a time specified in said notice, which time shall in no case be longer than the period of time specified in such agreements, respectively, for notice for their termination: *Provided*, That until the expiration of the period when the notice of intention to terminate hereinbefore provided for shall have become effective, or until such date prior thereto as the high contracting parties may by mutual consent select, the terms of said comercial agreement shall remain in force.

SEC. 4. That all Acts and parts of Acts in conflict with the provisions of this Act are hereby repealed, and that, except as provided in the first and second sections, hereof, this Act shall take effect and be in force from and after its passage.

To the champions of subsidies, which at best are only a temporary relief, I reply that we never can help our shipbuilding industries and restore our merchant marine unless we adopt the policy of free ships or discriminate in some way in favor of our own ships and against foreign ships. The fact is that we discriminate now by law aganst our own ships in favor of foreign ships. My plan is simply to reverse the situation. I sincerely believe that if my bill for preferential duties were enacted into law, the United States in a few years would become the mistress of the seas, and American ships built in our own shipyards would do all our own ocean commerce, besides a great part of the deep sea carrying trade of the other countries of the world, without taking a dollar out of the pockets of the taxpayers.

Let me say, in conclusion, that the policy I propose is not a makeshift. It is not new—having been the law of our country from 1792 to 1828, when it was suspended—and that suspension was one of the greatest political blunders in all our history. It is not a temporary expedient. It is permanent. It has been tried and not found wanting. It is the only way to restore the American merchant marine. Adopted again as our policy and upon the statute books, it will never be repealed, but, on the contrary, speedily restore our ocean carrying trade, revive our shipbuilding industries, give employment in our shipyards to thousands and thousands of men in all parts of the country, bring about an era of prosperity such as we have never known before in our shipping trade and deep sea commerce, place our flag on every sea and in every port, and make our seamen what they were in the historic days of the republic—the pride of America and the masters of the ocean highways of the world.

Smallpox in the United States in 1909

WHILE the sentimentalists are shouting "Anti-vivisection" and "Anti-vaccination" at us, the scientists are "sawing wood." A compilation from the State and city health reports for 1909 pertaining to smallpox has just been published by the Public Health and Marine Hospital Service. Complete reports are available for only twenty-six States and the District of Columbia. In all of these and in most of the other States the disease was prevalent during 1909.

The States showing the largest number of cases (over 1,000), as well as the rate per 100,000 of population, are shown in the following table:

	Number of Cases.	Cases per 100,000
Kansas	2,197	131.67
Illinois	2,135	38.31
Utah	1,854	507.11
North Carolina	1,733	79.45
Oklahoma	1,434	90.41
Minnesota	1,430	69.41
Louisiana	1,409	(Incomplete)
Indiana	1,363	50.74
Ohio	1,328	28.14
Wisconsin	1,208	52.14
Michigan	1,175	42.38

After Utah, with the exceptionally high rate of over 507 cases to 100,000, the highest rate was reported for Montana, 187.46 per 100,000 of population; then came Kansas and Oklahoma. The best showing was made by Florida, Connecticut and New Hampshire, which reported, respectively, 3, 3 and 2 cases.

The disease in 1909 was of a comparatively mild type, the death rate averaging less than 1 per cent. This is very low when compared to a mortality of from 18 to 28 per cent, which was the record in European outbreaks in recent years.

The importance of vaccination was again demonstrated by the outbreak of the disease in Yorkville, S. C., during March and April, 1909. The first case was that of a man of 32 years, unvaccinated, who died within two weeks. Fifteen persons had been exposed to infection from this case; of these only two had been vaccinated, one five years previously and the other forty-four years. These two nursed the patient for ten days, and neither contracted the disease. Of the other thirteen, eight died. Vaccination had been applied as soon as vaccine could be obtained; it was effective in five cases. And these were the cases that recovered. In the meanwhile all the other inhabitants of the town were vaccinated—about 400 in all; and although the thirteen persons who had contracted the disease from the first patient furnished seven centers for further infection, an epidemic was entirely prevented, only one other case developing, and that of a mild type.

The compilation, prepared by Assistant Surgeon-General John W. Trask, includes two maps of the United States, one showing the number of cases in each State and the other the rate per 100,000 for each State.

The Gem Production of the United States

THE total value of the precious stones produced in the United States in 1909 was $534,389, an increase of $118,317 over 1908. The increase is due, according to a press bulletin of the United States Geological Survey, to larger outputs of turquoise, tourmaline, variscite, chrysoprase, californite and kunzite. The production of beryl, garnet, peridot and topaz showed a decrease in value. The output of turquoise matrix and turquoise amounted to over 17 tons, that of variscite to over 3½ tons, and that of tourmaline to over 2½ tons. A beautiful new gem, benitoite, resembling the sapphire in some respects, has been found in San Benito County, Cal. Californite is compact, massive vesuvianite and resembles jade in hardness, texture and color, and should be a popular native gem. Chrysoprase has also been mined in California.

Deposits of turquoise have been worked in Arizona, California, Colorado, Nevada, New Mexico and Texas. Turquoise is generally found in arid or desert regions, where mining is difficult. New Mexico, California and Arizona were formerly the chief sources of turquoise, but during the last few years Nevada has been one of the principal producers. Variscite, like turquoise, is generally found in desert regions. The output formerly came from Utah under the names of utahlite, chlor-utahlite, amatrice and variscite, but since 1908 a number of deposits found in Nevada have contributed to the production. Recently there has been an increased demand for this gem in the matrix.—*The Engineering and Mining Journal.*

A Forest Service Circular on Colombian Mahogany

THE forester, the lumber dealer, and the wood user have long been painfully conscious of the prevalent tendency on the part of wholesalers to substitute one wood for another of better grade and quality. Even the importer of foreign woods will be surprised to learn from authoritative statements that more than 50 per cent of the bulk of the woods now shipped into this country as mahogany is not mahogany at all, but in the majority of cases such substitutes are much inferior woods. In a circular entitled "Colombian Mahogany, Its Use as a Substitute for True Mahogany," just issued by the Forest Service, Mr. George B. Sudworth, Dendrologist, and his assistant, Mr. C. D. Mell, call attention to the fact that fully 20 entirely different woods are now being sold as mahogany. They inform the readers that the Colombian mahogany (*Cariniana pyriformis*, Miers.), a wood from Colombia, has been sold in this country and abroad for more than thirty years as the genuine mahogany (*Swietenia mahagoni*, Jacq.). The circular is written with the greatest regard for scientific accuracy and thoroughness but in such a way as to interest the average intelligent reader. It contains excellent information for the wood user, but it embodies much interesting reading for the botanist as well. The first part of the publication gives the botanical characters of the tree yielding the Colombian mahogany and compares them with those of true mahogany. To the botanical description is added a general consideration of the source of supply, quality, chemical and physical properties of the wood and its uses. The circular describes very fully for purposes of identification by the unscientific reader the woods of these two species, treating with special fullness the minute structural characters of the wood of the Colombian mahogany. The rest of the circular is devoted to a clear presentation of the difference in structural characters between Colombian and true mahogany. In these days of substitution of lumber, this circular has a good claim to popular favor among mahogany consumers and buyers of furniture. It is a valuable contribution to the scientific knowledge of economic woods and the material should be useful to readers unfamiliar with the subject. The circular is profusely illustrated with numerous excellent black line drawings prepared by one of the best trained artists in the country.

The Shame of Eating

IN some primitive tribes, eating is regarded as something to be ashamed of. Karl von der Steiner, the celebrated explorer, was looked upon as a very ill-bred person by the natives of South American forests because he ate in the presence of others. The original ground of the shame associated with eating is a fear of evil spirits. The feeling of shame is not inborn in mankind and it assumes very different forms in different regions. A remnant of the superstitious fear connected with the act of taking food appears in the ejaculation "Prosit!" which, in Germany, is religiously uttered by the companions of a man who is about to take a drink. This Latin verbal form, the general meaning of which is "may it be beneficial," is now understood simply as the expression of a wish that the drink will agree with the drinker's constitution, but it originally connoted the hope that the drink had not been bewitched.

These statements are made by a writer in *Hygieia*, who adds that the division of labor between men and women was originally, and still is among primitive peoples, much more sharply defined than it is at present in civilized countries. This sharp division of labor brought about a separation at meals. The Eskimos have separate dishes for the two sexes, and a man would be deeply ashamed to eat with women. It is possible that the decoration of plates and cups was designed to serve as a counter-charm, as well as an ornament. When the fear of demons had passed, the custom of eating in private which that fear inspired was sometimes maintained by force of habit, so that eating in public came to be regarded as a shameful breach of good manners.

Our Merchant Marine and the South American Republics

First-class Ships as an Aid to Closer Commercial Relations

By the Hon. John Barrett, Director-General of the Pan-American Union

THIS is not an argument for or against so-called subsidies. It is a simple discussion of the subject of steamship connections between North and South America, without reference to partisan views or political policies. In the first place, there stands out a fact which is pre-eminently true: First-class steamship facilities for the exchange of trade products and the carrying of passengers and mails are just as necessary between countries separated by the high seas as first-class railroad facilities for similar purposes between countries and states separated only by bounuary lines. The better the railroad facilities the greater the trade exchange, the more travel, and the more frequent the mails. Correspondingly, the better the steamship facilities the greater becomes the commerce, the more general the travel and the more frequent the communication between countries and peoples widely apart.

Before developing further this subject in its relation to Latin America, one or two points should be cleared up. The statement is being continually made by those not familiar with the situation that trade between the United States and its sister republics can not be built up until it enjoys greatly improved steamship service. And the common supposition seems to be that not only passenger but freight lines are lacking to take care of the possib e business. While it is true that there are few passenger or freight boats flying the American flag, there is a large fleet of vessels flying foreign flags and conveying the traffic back and forth between North and South America. The high class fast passenger vessels of any flag running to the southern part of South America are indeed limited in number compared to those which ply between that part of the southern continent and Europe, but the number of freight vessels running from New York city, for example, to all sections of Latin America, is sufficiently large, and their sailings are frequent enough, to take care practically of all the freight that is offered, and, for the most part, at rates fair'y competitive with those of Europe. The only adverse criticism from the standpoint of the United States that can be made in regard to this situation, is that very few of these vessels are under the American flag, although there is no security that, even if they were, the rates would be any lower than they are at the present time.

Surveying the field from the north and working south, we find the conditions generally much better than the average man supposes. Every important port on the Gulf and Caribbean coasts of Mexico, the Central American republics, Panama, Colombia and Venezuela in northern South America, Cuba, the Dominican Republic, Haiti, and the West Indies can be reached by the vessels which provide abundant freight space and fairly good passenger accommodations, and in some cases the latter are excellent. Vessels are constantly running back and forth between these ports and New York city, Boston, Baltimore, New Orleans, Mobile, and Galveston. One line has recently made such improvement in its passenger arrangements out of both New Orleans and New York that there has been a gratfying increase in the number of passengers it has been carrying to and from ports on the Caribbean and the Gulf of Mexico.

Considering the east coast of South Africa, under which are comprehended Brazil, Uruguay and Argentina, and such well-known ports as Rio de Janeiro, Montevideo and Buenos Aires, it can be noted that there are abundant freight facilities for all the business that is offered either way. The passenger accommodations on some of these vessels have been greatly improved during the last two years, and still more notable advancement is to be made in the future. It is no longer necessary that the traveler, who wishes to be comfortable, should go to the east coast of South America by the way of Europe, if he is not too anxious to sail without any delay. In other words, if he is willing to adapt his sailing to certain vessels, he can, at least once or twice a month, get very good boats direct from New York to Rio de Janeiro and Buenos Aires. It must be admitted, however, that, if he is in a hurry, he can usually do better by proceeding directly to Europe and taking one of the fast English, German or French steamers.

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HON. JOHN BARRETT

Director-General of the Pan-American Union.

Considering the west coast of southern North America, that is of Mexico and Central America, and the republics bordering on the Pacific of South America, we find that there are fair facilities both for passengers and for freight from Panama south to the ports in Colombia, Ecuador, Peru, Chile, and, via both Peru and Chile, to Bolivia. Steamers leave at least once a week from Panama for such ports as Guayaquil, Callao, Mollendo, Iquique and Valparaiso. There has been much improvement of late in these routes, new steamers having been put on by the lines operating, while others are to be placed in commission as soon as constructed. The service between the Pacific coast of the United States and the west coast of Mexico, Central America and Panama is somewhat limited, but seems at the present time to take care of nearly all the business that is offered. There is no question that these lines will be improved by the time the Panama Canal opens, and several companies, planning to enter the field, are now only awaiting developments in connection with canal tolls to decide what they will do.

What I desire to see, as an international officer, is not only more steamers put on flying the American flag, but more flying any flag. The greater the competition and the more vessels there are, the greater will be the effort of business interests to get into the field. The buying and selling between North and South America will grow with better steamship facilities, no matter what the flag, just as trade grows on land between different States and citizens with better railroad connections between them. Perhaps I am not as strong as I should be for special laws in favor of the shipping of the United States, because in my capacity as a Pan-American officer I want to see the countries of Latin America, like Mexico, Peru, Chile, Argentina and Brazil, putting on vessels which will ply between the ports of their countries and those of the United States. I think it would be unfortunate to discriminate in shipping tolls through the Canal in favor of the vessels of the United States unless they are engaged in the coastwise trade. In other words, I believe it would be a cardinal error to allow a vessel flying the United States flag plying, for example, between the United States and Chile, to have any advantage in canal tolls over the vessel flying the Chilean flag which might do business between Chile and the United States. It is to be hoped that there will not be any legislation which would discriminate against ships of other nations going through the Canal and engaging in international commerce. Such action of the United States might naturally be considered by the twenty countries lying to the south of us as being adverse to international comity and the development of friendly relations.

Viewing some practical phases of the situation, we can not overlook the necessity of having the best arrangements for the exchange of mail. The more frequently and the more rapidly letters, papers, reports and other data can be exchanged between the United States and all the countries to the south of it, the more rapidly will trade develop. The European countries have benefited enormously from excellent mail facilities with Latin America, and the business men of the United States will find when this handicap is overcome that a great increase in their trade will result. It must also be borne in mind that there is no better way of developing trade than the mutual acquaintance of both buyers and sellers. If the steamship facilities between the United States and Latin America are so improved that the average business man and tourist of the latter can travel to and from the former with the same speed and comfort that he can travel to and from Europe he will go to the United States, get acquainted with its people, its institutions, its business men, its conditions of trade, and will both purchase and sell there to a far greater degree than ever before. The importers of Latin America enjoy combining business with pleasure, and, in seeking the combination of both, they find the steamships which take them to and from Europe offer greater inducements than those which take them to

and from the United States, although of late, in response to the efforts of one company to better its service, there has been a notable change in favor of visiting the United States. The conclusion must be that the more this service improves the more will Latin Americans come to the United States. Correspondingly, a large element of American exporters and business men who now visit Europe or Asia will go only too readily to Latin America when they realize that they can travel in comfort. The knowledge that the facilities are already much better than they were formerly has resulted in a considerable increase of Americans going directly to Latin America from New York, New Orleans, and San Francisco, and there are indications that the travel next year will be far larger than ever before.

As supporting the contention that improved steamship service will not fail of appreciation by the business interests of North and South America, it is well to bear in mind some of the present conditions of Pan-American trade. The great majority of the people of the United States do not realize how extensive already is the exchange of products between North and South America, and how rapidly this business has developed during the last ten years. Too many manufacturers, merchants, importers and exporters, who have not studied the field and the facts, are inclined to pooh-pooh its importance and opportunity, and therefore make no effort to enter it. The truth is that the export and import trade of the United States with the twenty Latin-American countries lying to the south of it has grown with remarkable and gratifying rapidity during the last ten or fifteen years. If it has been able to make this advance under what are generally considered adverse steamship conditions, it must be admitted that it will make far greater progress in the future, when these facilities are extended and improved.

The total annual value of exports and imports exchanged between the United States and its sister republics approaches now six hundred and fifty millions of dollars. Fifteen years ago it did not exceed two hundred and fifty millions of dollars. This means a remarkable growth of four hundred millions of dollars in little more than a decade. This, in turn, is a percentage not surpassed by the trade of the United States with any other section of the world, and in startling comparison with the trade of the United States with Asia, which has practically stood still, and, in the case of some countries, has actually decreased.

The evidence that this annual commerce of six hundred and fifty millions of dollars has an opportunity of expansion is shown in the fact that the total foreign trade of Latin America exceeds now two billions of dollars per annum. The share of the United States therefore is greater than one-fourth—certainly a condition against which there can be little complaint when we consider the activity of the business interests of Great Britain, Germany, France, Belgium, Holland, Spain, Portugal, and Austria-Hungary.

As a specific illustration of the value of Pan-American foreign commerce, the foreign trade of Argentina can be cited. Last year this exceeded seven hundred millions of dollars, an average of nearly one hundred dollars per head, and larger than the foreign trade of either Japan or China.

In studying these figures of Latin-American trade, it is interesting to note what may be the opportunity for steamships plying through the Panama Canal. The five countries which form the western or Pacific slope of South America, including Colombia, Ecuador, Peru, Bolivia, and Chile, last year bought and sold with the rest of the world a commerce valued in excess of three hundred millions of dollars. If they can conduct a business of this size, despite their isolated position, they should be able to double it within a few years after the opening of the Canal, and the share of the United States in view of its new proximity, brought about by the Canal, should grow more rapidly than that of any other country. There will be a demand for an increased fleet of vessels to run directly between the principal ports of the Atlantic and Gulf coasts of the United States and those of the western shore of South America, which reaches for five thousand miles from Panama to Punta Arenas. There will also be a demand for more vessels to communicate through the Canal with the west coast of Central America and Mexico, which reaches for nearly three thousand miles from Panama to San Diego. This section of Latin America, that is, the portion bordering on the Pacific Ocean, now conducts a foreign commerce in excess of one hundred millions of dollars per annum—a total which will double within five years after the Canal is opened if there are satisfactory steamship facilities.

The Present Status of Cancer Research

By Dr. Moyer S. Fleisher, Barnard Free Skin and Cancer Hospital, St. Louis, Mo.

IT is now scarcely ten years since the experimental investigation of the cancer problem was first entered upon, and therefore we are to-day only on the threshold of a true and definite knowledge regarding cancer. While for many years, indeed, since the first half of the last century, the problems of cancer, its origin and nature, have occupied the thoughts of investigators, it was not until the early part of this century, under the stimulus of successful experimental work carried out by Loeb (an American investigator) on rats, and later, though independently, by Jansen (a Danish investigator) on mice, that general interest was awakened in this subject.

Before this time almost all investigation concerning cancer had been limited to the microscopical examination of these tumors and by means of this examination cancers had been classified, and there developed as a result of these investigations a multitude of purely hypothetical theories regarding the cause of cancer.

It may be advisable to pause here and define what a cancer is. A cancer is a mass of cells, whose origin is from the cells which normally constitute our bodies. The structure of the cancer cells is similar to that of the normal cells. These cancer cells, unlike normal cells of the adult body, have the power of very rapid growth or proliferation. In the course of this rapid growth the relationships of the cancer cells to one another, or to neighboring cells, deviate to a greater or less degree from those of their parent cells. They not only break through their normal boundaries, and invade and destroy the surrounding normal tissue, but also individual cells or masses of cancer cells may be carried in either blood or lymph vessels, to parts of the body distant from their site of origin, and may there continue their rapid growth and constitute secondary cancers, which are spoken of as metastases.

Under the general term of cancer we group all abnormal malignant growths which have the above characteristics; however, there are two distinct types of cancer. It must be clearly understood that the body is composed of many different kinds of cells, and that various groups of specialized cells form what we call organs. It is, however, possible to group these cells under two headings; the first are called epithelial cells; under this group are included the cells lining the alimentary tract, and the air passages, the superficial cells of our skin and the more important cells of the glands within our bodies. These epithelial cells give rise to a type of cancer which we call carcinoma. The second type of cells, which form the supporting and connecting structures for the epithelial cells, are called connective tissue cells, and give rise to a type of cancer called sarcoma.

During the years that our knowledge of malignant growths was being obtained only by means of the microscope, various theories were advanced to explain both the origin of and the phenomena connected with cancer. The theories which were advanced may be roughly divided into two groups.

In the first of these the cause of cancer was said to be a pre-natal influence on either single cells or groups of cells. Thus Cohnheim believed that during the time of embryonic development groups of cells were separated from their normal relations within the developing body, and, until some stimulus or impulse set them into activity, these groups of cells remained quiescent. When once set into activity they again took on their embryonic quality, namely, power of rapid proliferation, and now developed as a cancer.

While this theory serves to explain at least in part the origin of certain tumors, it fails to explain the origin of the true malignant tumors which we speak of as cancers. Ribbert holds that during the prenatal period, or during the adult life, cells may be split off from their usual surroundings, and now take on the power of unchecked growth which we may consider as one of the characteristics of cancer.

In the second group are those theories in which the cause of cancer is supposed to be an acquired abnormality, a change within the cells of the adult body. These changes are supposed to be represented by chemical, physical or structural variations of the cells, or again the cells are supposed to have taken on new functions or activities.

While these theories might serve to explain the origin of cancer from individual cells or from groups of cells in the body, they fail to point why these cells acquire the qualities which we associate with cancer. Many theories were therefore advanced to explain why either quiescent embryonic cells or even normal cells should suddenly take on the power of unlimited growth. Various investigators offered suggestions that the structure of cells was changed or influenced in certain ways, but none of these hypotheses were supported by definite experimental proof.

It is only since it was first learned that cancer could be transmitted from one animal to another that our knowledge of this disease has been obtained by experimental means.

It has been known for many years that the lower animals developed cancers which were similar to those seen in human beings. In certain kinds of animals cancers appeared more frequently than in others, and it was noted that in rats and mice may cases of spontaneous cancer occurred. The term spontaneous cancer is used here in order to distinguish the cancers which arise *de novo* from the "inoculated" cancers, produced by grafting a portion of a spontaneous cancer on a normal animal. The knowledge that a spontaneous cancer can be inoculated into many series of normal animals forms the keystone of experimental cancer research.

In transmitting cancer from one animal to another some of the cells of a cancer are grafted on a normal animal (usually in the loose tissue under the skin); these implanted cells of the first animal grow, divide and multiply rapidly; thus we have growing in the second animal a cancer composed of the cells of the first animal. It must be distinctly understood that the cancer in the second animal is in reality composed of cells of the first animal and the cells of the second animal, as a rule, take no part in the formation of the cancer. This inoculated cancer may then be transmitted to a third, fourth or even an unlimited series of animals, so that the cancer cells of the first animal may be transmitted through many generations of animals and may be kept alive long after the death of the first animal.

The experimentation on animals has as yet not brought any definite results as to what may be the cause of cancer, although some very suggestive and unexpected facts have been discovered.

What role heredity may play in either development or tendency to development of cancer is as yet uncertain, and the relatively small number of experiments which have so far been carried out in this line are only suggestions of future possibilities. It has been noted that within a relatively short period of time three cases of a rare kind of cancer developed in one family of rats. It seems more likely that these cases were due to some heredity factor than that they were due to infection. As yet no systematic and extensive work has been carried out which allows of any generalization regarding the influence of heredity. We know, however, that heredity plays a part in transmitting certain qualities which are favorable or unfavorable to the growth of transplanted tumors.

For many years efforts have been made to show a causal relationship between micro-organisms and the development of cancer, and thus to prove that cancer is of an infectious nature, as diseases such as typhoid fever, diphtheria or tetanus.

Certain statistical studies which show the prevalence of cases of cancer in certain districts, the occurrence of epidemics of cancer cases, or the repeated occurrence of cancer in certain houses, would seem possibly to point to such an origin; but on the other hand, in these cases, heredity and various other factors which must be taken into consideration cannot be excluded.

It has been noted in a few cases that when animals were inoculated with a certain kind of cancer (in the majority of cases with carcinoma), there developed in the inoculated animal a second kind of cancer (a sarcoma). One may here consider that the cells of the inoculated cancer have carried the cancer parasite which has then exerted its influence on the second class of cells. It is of course impossible to exclude the suggestion that the carcinoma cells may have acted as an irritant, and thus led to the development of a sarcoma from the neighboring cells.

Many investigators have attempted to demonstrate specific parasites as the cause of cancer. Bacteria, yeasts, and even mites have been cultivated from

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The Merchant Marine as an Auxiliary to the Navy

Navy Would Need Some Nine Hundred Merchant Vessels to Draw from in Case of War

By T. G. Roberts, Naval Constructor United States Navy

IN order to bring home to our people a realization of the true importance of the question of providing an adequate merchant marine, what force of words or arguments, or what array of facts and statistics, are necessary, beyond the multitude already available that have but recently fallen upon unheeding minds amid unpropitious times?

A navy is not fully complete without those auxiliary vessels which only a numerous merchant marine can supply—and a healthy merchant marine is the greatest need of this country to-day. After the outbreak of war, merchant ships cannot be improvised any more than battleships. A nation that would pretend to be a world power could not hope actually to achieve such a position while neglecting those very instruments without which potentiality cannot possibly be maintained. Aside from the lack of that instrumentality for trade which a merchant marine supplies, it is inconceivable that a country as great and rich as ours, with a government so liberal and enlightened, could blindly neglect a source of sea power so essential, if we are to avoid in the event of war a possible defeat upon the sea, with the Philippines, the Panama Canal and the Monroe Doctrine at stake—a defeat that would not only cost us a great loss of prestige, but would be all but irretrievable in effect. When the actual cost of providing an adequate merchant marine is considered—not over $15,000,000 a year—it is all the more incomprehensible that we should neglect that balance of sea power now standing between us and an effective readiness, and at the same time thereby contribute to foreign shipping companies the profits on carrying annually about $3,000,000,000 worth of imports and exports, at a cost of something like $300,000,000 a year, and furnish them with the trade to keep them in existence, with their vessels available to foreign governments, through foreign subsidies, to be used against us upon the outbreak of war. Thus, in the item of merchant marine auxiliaries, we have not only handicapped our sea power doubly, but our merchant shipping has also become the laughing stock of all the world and the butt for jokes of the sailor men of all nations.

A Contrast in Preparedness.

At the outbreak of our Spanish war we had practically no naval auxiliaries, but Congress immediately voted $50,000,000 for the national defense. Of course this money went for almost everything immediately or remotely connected with the prosecution of the war, all the way from the mobilizing of the army to the purchasing and fitting out of auxiliaries for the navy. About one hundred merchant and other vessels were purchased and fitted out as naval auxiliaries, of which over half consisted of yachts and tugs. Many owners showed the patriotic willingness to let the government have their vessels, but the figures at which they went were characteristic of the phenomenal increase in the stress of war times in the values of articles which a government must have, a condition which has grown proverbial in history. Just how much these yachts and tugs and second-class merchantmen contributed to the victory is difficult to estimate, but it is safe to say they could not have filled the vacancy caused by the absence of an adequate merchant marine in case the war had been extended across seas, or in the case of any material resistance from the Spanish fleet, which by its predestined collapse rendered the naval auxiliaries a question of minor importance. How different with the merchant marine of Japan in the late Russian war! The following quotations were taken, with approval, by the Merchant Marine Commission from the *Nautical Gazette* of January 26th, 1905, containing an editorial from the *Japan Daily Mail*, relative to the steamship lines. We read that "despite the disadvantages to which the Nippon Yusen has been put by reason of the war, the company has been able to pay its shareholders a dividend of 12 per cent. The *Japan Daily Mail* says: 'We cannot dismiss the subject without noting the situation in which the country would have been placed had the outbreak of war found it without the splendid transport facilities by the Nippon Yusen Kaisha's fleet. In the piping times of peace unreflecting persons are apt to look askance at the great shipping companies which received a substantial measure of state aid and show enviably prosperous balance sheets. But the truth is that such companies are just as essential to the safety and independence of the empire as are its army and its navy. Without them, indeed, the army's field of potentiality is strictly limited to domestic territories, and in Japan's case it may be truly said that did she not possess the Nippon Yusen Kaisha she would have to submit tamely to compulsory exclusion from the continent of Asia, and to see Manchuria and Korea pass finally under Russian sway.' Americans as a rule have admired and applauded Japan in her endeavor to rise to a position of strength as a modern nation. That her wisdom in creating a merchant marine has been so well justified in the present war should be a cause of congratulation. The United States can take a lesson from Japan's experience."

Of our ten foreign-going merchant vessels flying the American flag, only the four of the American Line have the benefit of mail subsidies under the law of 1891, and are available for naval auxiliaries. The coast-line shipping is absolutely protected by laws practically prohibiting foreign vessels from participation, the rates being determined from competition with the railroads, and so, are absolutely independent of and incomparable with the foreign ocean rates. Though fully protected by law, but not by subsidies, these coast steamers are under no obligation to the government, and are not necessarily available for use as auxiliaries in time of war.

The General Board of the Navy Department, in 1905, responding to an inquiry from the Senate relative to the number of naval auxiliaries needed from a merchant marine, reported that, at that time, with the twenty-seven battleships then in prospect and the other ships available, the navy would need 171 auxiliaries to be drawn from the merchant marine in order to go to war properly. With respect to this number, the board said: "In order to be sure that this number of vessels would be available for immediate purchase or charter by the Navy Department at the outbreak of war, the number of American-owned merchant vessels of each type should be largely in excess of the number here given, as some vessels would be abroad when needed, some under repairs, and some should be left for carrying on their regular commercial runs and as a reserve from which to draw in case of necessity. . . . Another benefit which would accrue to the navy from a large fleet of American-owned vessels would lie in the large number of experienced sea-going men, engineers, and firemen accustomed to marine engines and boilers, who would form a valuable reserve from which to draw the men for manning the auxiliaries."

Supposing we had a merchant marine adequate for us to draw, say, one-fifth for immediate purposes, that would require a total merchant shipping of 855 vessels. We have four now available and might be able to purchase, say, 100 vessels of the smaller classes, as in the case of the Spanish war. It will thus be seen how far we are from possessing the auxiliaries absolutely essential to prosecute a foreign war. In the event of such war the forty-nine colliers under foreign flags that supplied the fleet with coal during their voyage around the world would be unavailable by the mere operation of the laws of neutrality, and their places would be supplied by a vacancy which would strike our fleet with such force and such emphasis as would cause the American people to wake up and indulge in somewhat belated serious reflections.

In the event that troops should have to be transported across the seas the need of suitable vessels for army transports would be even more imperative than the naval auxiliaries. In 1905 the Army War College reported for the information of the Merchant Marine Commission that, to provide for an expedition of two divisions from either coast, an aggregate of 228 vessels, available in fifteen days, on both coasts, would be required. If such a levy should call into immediate service say one-fifth of our imaginary merchant marine, that would indicate a merchant marine of 1,140 vessels to draw from. I have said one-fifth at the first draw, because the merchant marine would have to supply additional vessels for subsequent needs in numbers depending upon the duration of the war and the casualties; and, furthermore, because no country expects to divert its entire merchant marine to the purposes of war, but of course plans to carry on its commerce with other nations during the war. Adding the 1,140 vessels necessary to supply the army needs to the 855 or navy needs, makes a total of 1,995 vessels of suitable size and speed which our merchant marine should contain. These figures are liberal, and provide an ample supply, and might be reduced to a minimum of one-fifth, or say 400 vessels, based on the assumption that the first expedition would be sufficient, and that all these vessels would be positively available to the government for war purposes, and that our corresponding commerce should cease during the war. Comparing this minimum with the four merchant vessels now available, plus the few transports belonging to the army and the limited number of auxiliaries belonging to the navy, we find ourselves poor indeed.

The Foreign Shipping Interests.

Such a pitiable condition is all the more grievous from the outlook toward remedial legislation, and when we contemplate the enlightened but ineffectual efforts that have been expended now these seven years past with only a retrograding effect, we are torn with conflicting emotions—on the one hand with solicitude for the future preservation of our as yet untarnished national escutcheon; on the other hand with admiration for the foreign shipping interests, and the power and influence they have been able to wield so effectually in a country foreign to their own. Out of the congressional revelations of last year it developed incidentally that the foreign shipping interests control in the main practically all the commerce between this and foreign countries, both on land and sea, by rail and steamer; and that this control is exerted by a gigantic trust, with headquarters in Germany, that kills competition by Standard Oil methods. It is understood the government has entered suit in the Court of Equity under the Sherman anti-trust law against this monopoly in the manipulation and control of the passenger business, and the foreigners have taken the ground that this government has no jurisdiction over a foreign corporation. The recent decision of the Supreme Court in the case of the Tobacco Trust, which applied the Sherman anti-trust law with full force to the two English companies doing business in this country, now renders it a foregone conclusion that the foreign shipping trust, both in its passenger and freight combines, will be ultimately dissolved as far as evidences of it are available on our shores; but it ought to be realized that, thereafter, such evidences must be necessarily very intangible and inconclusive. "The mountains have labored and a ridiculous mouse will be born." Whatever becomes of our prosecution of the foreign shipping trust, though it be actually dissolved, which is hardly conceivable, and though by such dissolution the conditions may render possible the upbuilding of competing lines, yet those conditions alone will not produce an American merchant marine, unless and until our government shall plant the seed by new legislation, and cherish and protect the plant with favorable laws. Else, the foreign grip upon our ocean shipping will remain unshaken; and to loosen it at all now will require a new birth of patriotism all over this land, sufficient to shake off this lethargy and awaken our people to a realization of their true condition of subserviency to the foreign shipping interests.

Ways and Means.

Notwithstanding the prejudice, both inspired and innocent, existing in this country against ship subsidies, it remains a fact that subsidies are the instrumentality through which existing merchant marines have been created and maintained. Subsidies and merchant marines are inseparable companions.

The constitution of the United States provides that treaties with foreign nations are a part of the supreme law of the land, and hence they cannot be set aside by a mere statute. There is now a clause in the Dingley tariff law which discriminates in favor of goods brought in American ships, but it is a dead letter, and has been set aside by the Board of General Appraisers as conflicting with our treaties. Discriminating duties must be preceded by the abrogation of about thirty treaties with foreign nations. The difficulties involved, together with the risk of retaliation, render that course well-nigh impracticable, though not impossible. Heretofore the advocacy of discriminating duties has been a means of opposition and of procrastination; with the present composition of Congress, however, it becomes not only a possibility but a live proposition. It is quite conceivable

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Clearing the Ocean Highway

The Derelict Destroyer "Seneca" and Her Work

By Walter Bernard

Of all the perils which beset ocean navigation, perhaps the most insidious, because the most elusive and difficult to guard against, is the derelict—the abandoned and almost submerged, but still floating wreck. When a vessel of stout construction, particularly if she be built of timber, is loaded with a cargo that is lighter than the water, she may sink until she is in the awash condition, and, by virtue of the strength of her hull, may hold together for many years, floating hither and thither at the caprice of wind and tide, and so constitute a perpetual menace to navigation. The ever-shifting wreck is naturally uncharted; and although a vigilant watch by day may suffice to detect the danger, in the night time the obstacle is quite invisible, and should it lie in the direct track of a ship a collision is unavoidable.

Unquestionably the floating derelict has been answerable for not a few of the unexplained losses of staunch and well-found ships, instances of which are too many and well known to need any recapitulation here.

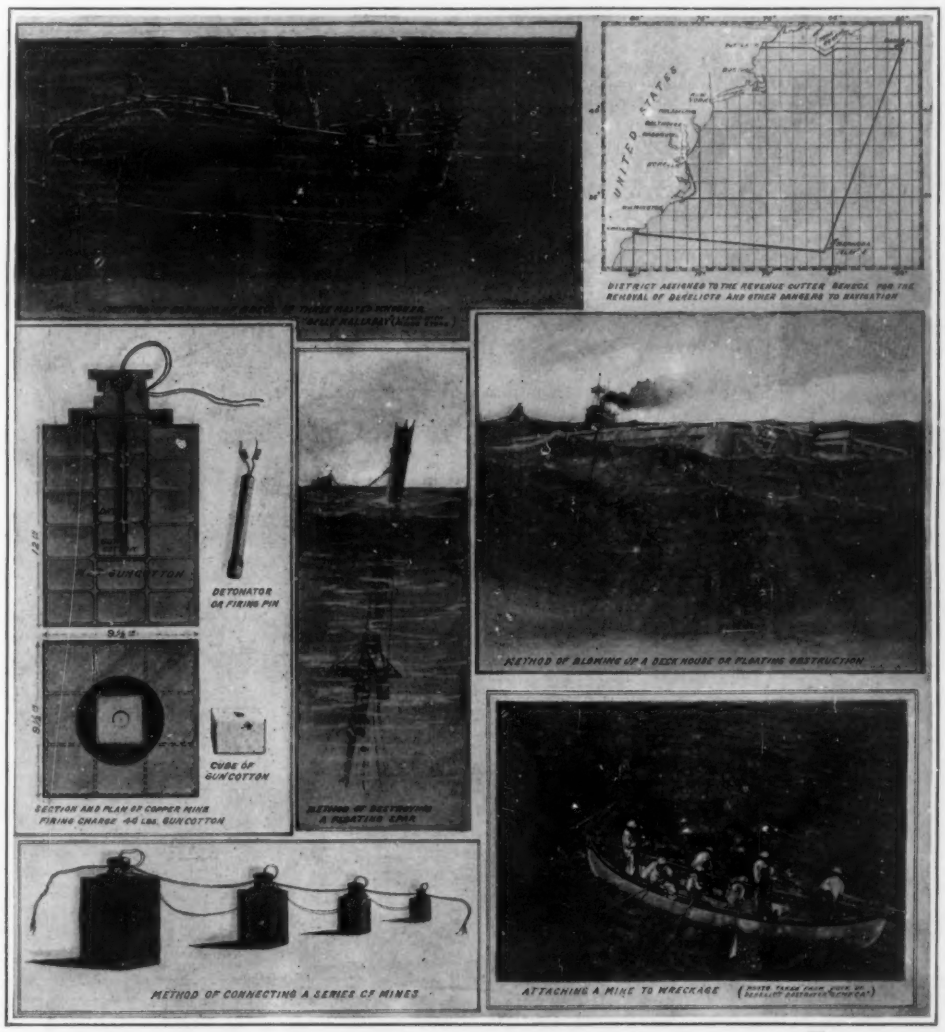
The endurance of the derelict and the extent of its ocean wanderings are almost unbelievable. Take the case of the Norwegian bark "Crown," lumber-laden, which was abandoned in a supposedly sinking condition in mid-Atlantic on December 26th, 1909. In the following May it was reported as on the edge of the Sargasso Sea, and at a later date it was sighted upon the other edge of the sea, having traversed in the interval eleven hundred miles. In the summer of 1910, it was sighted between Charleston, S. C., and Bermuda.

Take, again, the case of the "Fannie E. Woolston," which was wrecked on the Jersey coast October 15th, 1891. During the following three years the wreck was frequently sighted; once off the coast of Africa, and later on the opposite side of the Atlantic, off the coast of Florida. Finally it dropped entirely out of sight.

Lloyds, of London, has developed an effective system for tracing ocean derelicts, and whenever one is sighted in any of the seven seas, it is reported to headquarters, and means are taken to intercept and destroy it.

We present illustrations of the "Seneca," a deservedly popular vessel, which was recently built for the United States Revenue Cutter Service, for the purpose of patroling the seas contiguous to the Atlantic coast and locating and destroying both derelicts and sunken wrecks that are a menace to navigation. The patrol ground of the "Seneca" lies within a line drawn from Charleston, S. C., to just west of the Bermuda Islands; then northeast to Sable Island; and from thence westerly to the coast of Maine. Generally speaking, the vessel has no particular orders, but is free to go and come when and where her captain, George C. Carmine, may think fit. Her specific duty is to locate and destroy wrecks, and to render assistance to vessels which may be in distress whether ashore or at sea. Her home station is Tompkinsville, Staten Island, to which reports of the sighting of derelicts are brought in by shipping or by wireless, or by cable from Lloyds.

We present a series of engravings showing the methods adopted by the "Seneca" in destroying derelicts and floating wreckage. The explosive used is guncotton, which is carried in boxes, and is charged into copper can'sters (mines) which measure 9½ by 9½ inches, by 12 inches in height. Each mine is loaded with 50 cubes of guncotton, each measuring 3 inches by 3 inches, by 2 inches in height, which are snugly packed within the canister, in the manner shown. In the center of the canister is a copper case containing a firing charge of dry guncotton, within which is a primer of fulminate of mercury, which is electrically detonated. Cables lead from the primer up through a threaded cap, beneath which is a rubber ball which, as the cap is screwed down, is compressed against the cables and forms a watertight joint. Rubber gaskets also serve to make a tight joint for the main cap which closes the top of the canister. A battery is used for firing. The canister as shown above is standard for all explosions, as many of them being used as is necessary to do the work.



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CLEARING THE OCEAN HIGHWAY

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A frequent and dangerous obstruction is the floating mast, which generally is found bottom upward, with a portion of the mast showing above the surface and the heavier end of it, containing the heavy masthead iron fittings and gear, floating many feet below. In this case, a mine is suspended on a heavy chain ring, which is placed over the mast and allowed to slip down to its bottom. The crew row off to a distance of several hundred feet, paying out the firing cable as they go; then, by pressing the button, the mast is shivered into splinters.

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The blowing up of derelicts and the destruction of wreckage, however, by no means represents all the duties of the "Seneca." Her work in the salvage of ships and the saving of human lives has been arduous and highly meritorious. It will be remembered that several times during the past winter she did noble work of this character.

Bacteria as Indicators of Soil Acidity

THE longer a soil is used for producing crops, the more acid it accumulates. As most cultivated plants cannot thrive in an acid soil, it becomes necessary to employ larger and larger quantities of lime for neutralizing the increasing soil acidity. It thus becomes desirable to have a convenient method for determining the acidity of agricultural soils. The chemical methods heretofore used are cumbersome and unsatisfactory.

Prof. J. G. Lipman of Rutgers College has been conducting experiments with a view to finding a more expeditious and more reliable method for determining soil acidity and has obtained some interesting results by employing bacteria. His method rests upon the well known fact that bacteria will not multiply in a medium containing more than a certain percentage of acid. By comparing the growth of bacteria in a number of bouillon preparations to which varying quantities of sterilized soil have been added, it may be readily seen at what point the growth of the bacteria is stopped, and accordingly the amount of acid in the soil may be calculated. In one set of experiments ammonia-producing bacteria were used. A known quantity of soil is added to the bouillon, and after the action of the bacteria has proceeded a certain length of time, the ammonia is distilled into standard acid and the amount determined. The amount of ammonia produced would vary inversely with the acidity of the soil, since the more acid there is in the soil the more would the activity of the bacteria be restrained. Other experiments were made with nitrifying bacteria in nitrogen-free media, the amount of nitrate produced being used as an indication of the presence of acids.

The Merchant Marine as an Auxiliary to the Navy

Navy Would Need Some Nine Hundred Merchant Vessels to Draw from in Case of War

By T. G. Roberts, Naval Constructor United States Navy

IN order to bring home to our people a realization of the true importance of the question of providing an adequate merchant marine, what force of words or arguments, or what array of facts and statistics, are necessary, beyond the multitude already available that have but recently fallen upon unheeding minds amid unpropitious times?

A navy is not fully complete without those auxiliary vessels which only a numerous merchant marine can supply—and a healthy merchant marine is the greatest need of this country to-day. After the outbreak of war, merchant ships cannot be improvised any more than battleships. A nation that would pretend to be a world power could not hope actually to achieve such a position while neglecting those very instruments without which potentiality cannot possibly be maintained. Aside from the lack of that instrumentality for trade which a merchant marine supplies, it is inconceivable that a country as great and rich as ours, with a government so liberal and enlightened, could blindly neglect a source of sea power so essential, if we are to avoid in the event of war a possible defeat upon the sea, with the Philippines, the Panama Canal and the Monroe Doctrine at stake—a defeat that would not only cost us a great loss of prestige, but would be all but irretrievable in effect. When the actual cost of providing an adequate merchant marine is considered—not over $15,000,000 a year—it is all the more incomprehensible that we should neglect that balance of sea power now standing between us and an effective readiness, and at the same time thereby contribute to foreign shipping companies the profits on carrying annually about $3,000,000,000 worth of imports and exports, at a cost of something like $300,000,000 a ..r, and furnish them with the trade to keep them ... existence, with their vessels available to foreign governments, through foreign subsidies, to be used against us upon the outbreak of war. Thus, in the item of merchant marine auxiliaries, we have not only handicapped our sea power doubly, but our merchant shipping has also become the laughing stock of all the world and the butt for jokes of the sailor men of all nations.

A Contrast in Preparedness.

At the outbreak of our Spanish war we had practically no naval auxiliaries, but Congress immediately voted $50,000,000 for the national defense. Of course this money went for almost everything immediately or remotely connected with the prosecution of the war, all the way from the mobilizing of the army to the purchasing and fitting out of auxiliaries for the navy. About one hundred merchant and other vessels were purchased and fitted out as naval auxiliaries, of which over half consisted of yachts and tugs. Many owners showed the patriotic willingness to let the government have their vessels, but the figures at which they went were characteristic of the phenomenal increase in the stress of war times in the values of articles which a government must have, a condition which has grown proverbial in history. Just how much these yachts and tugs and second-class merchantmen contributed to the victory is difficult to estimate, but it is safe to say they could not have filled the vacancy caused by the absence of an adequate merchant marine in case the war had been extended across seas, or in the case of any material resistance from the Spanish fleet, which by its predestined collapse rendered the naval auxiliaries a question of minor importance. How different with the merchant marine of Japan in the late Russian war! The following quotations were taken, with approval, by the Merchant Marine Commission from the *Nautical Gazette* of January 26th, 1905, containing an editorial from the *Japan Daily Mail*, relative to the steamship lines. We read that "despite the disadvantages to which the Nippon Yusen has been put by reason of the war, the company has been able to pay its shareholders a dividend of 12 per cent. The *Japan Daily Mail* says: 'We cannot dismiss the subject without noting the situation in which the country would have been placed had the outbreak of war found it without the splendid transport facilities by the Nippon Yusen Kaisha's fleet. In the piping times of peace unreflecting persons are apt to look askance at the great shipping companies which received a substantial measure of state aid and show enviably prosperous balance sheets. But the truth is that such companies are just as essential to the safety and independence of the empire as are its army and its navy. Without them, indeed, the army's field of potentiality is strictly limited to domestic territories, and in Japan's case it may be truly said that did she not possess the Nippon Yusen Kaisha she would have to submit tamely to compulsory exclusion from the continent of Asia, and to see Manchuria and Korea pass finally under Russian sway.' Americans as a rule have admired and applauded Japan in her endeavor to rise to a position of strength as a modern nation. That her wisdom in creating a merchant marine has been so well justified in the present war should be a cause of congratulation. The United States can take a lesson from Japan's experience."

Of our ten foreign-going merchant vessels flying the American flag, only the four of the American Line have the benefit of mail subsidies under the law of 1891, and are available for naval auxiliaries. The coast-line shipping is absolutely protected by laws practically prohibiting foreign vessels from participation, the rates being determined from competition with the railroads, and so, are absolutely independent of and incomparable with the foreign ocean rates. Though fully protected by law, but not by subsidies, these coast steamers are under no obligation to the government, and are not necessarily available for use as auxiliaries in time of war.

The General Board of the Navy Department, in 1905, responding to an inquiry from the Senate relative to the number of naval auxiliaries needed from a merchant marine, reported that, at that time, with the twenty-seven battleships then in prospect and the other ships available, the navy would need 171 auxiliaries to be drawn from the merchant marine in order to go to war properly. With respect to this number, the board said: "In order to be sure that this number of vessels would be available for immediate purchase or charter by the Navy Department at the outbreak of war, the number of American-owned merchant vessels of each type should be largely in excess of the number here given, as some vessels would be abroad when needed, some under repairs, and some should be left for carrying on their regular commercial runs and as a reserve from which to draw in case of necessity. . . . Another benefit which would accrue to the navy from a large fleet of American-owned vessels would lie in the large number of experienced sea-going men, engineers, and firemen accustomed to marine engines and boilers, who would form a valuable reserve from which to draw the men for manning the auxiliaries."

Supposing we had a merchant marine adequate for us to draw, say, one-fifth for immediate purposes, that would require a total merchant shipping of 855 vessels. We have four now available and might be able to purchase, say, 100 vessels of the smaller classes, as in the case of the Spanish war. It will thus be seen how far we are from possessing the auxiliaries absolutely essential to prosecute a foreign war. In the event of such war the forty-nine colliers under foreign flags that supplied the fleet with coal during their voyage around the world would be unavailable by the mere operation of the laws of neutrality, and their places would be supplied by a vacancy which would strike our fleet with such force and such emphasis as would cause the American people to wake up and indulge in somewhat belated serious reflections.

In the event that troops should have to be transported across the seas the need of suitable vessels for army transports would be even more imperative than the naval auxiliaries. In 1905 the Army War College reported for the information of the Merchant Marine Commission that, to provide for an expedition of two divisions from either coast, an aggregate of 228 vessels, available in fifteen days, on both coasts, would be required. If such a levy should call into immediate service say one-fifth of our imaginary merchant marine, that would indicate a merchant marine of 1,140 vessels to draw from. I have said one-fifth at the first draw, because the merchant marine would have to supply additional vessels for subsequent needs in numbers depending upon the duration of the war and the casualties; and, furthermore, because no country expects to divert its entire merchant marine to the purposes of war, but of course plans to carry on its commerce with other nations during the war. Adding the 1,140 vessels necessary to supply the army needs to the 855 or navy needs, makes a total of 1,995 vessels of suitable size and speed which our merchant marine should contain. These figures are liberal, and provide an ample supply, and might be reduced to a minimum of one-fifth, or say 400 vessels, based on the assumption that the first expedition would be sufficient, and that all these vessels would be positively available to the government for war purposes, and that our corresponding commerce should cease during the war. Comparing this minimum with the four merchant vessels now available, plus the few transports belonging to the army and the limited number of auxiliaries belonging to the navy, we find ourselves poor indeed.

The Foreign Shipping Interests.

Such a pitiable condition is all the more grievous from the outlook toward remedial legislation, and when we contemplate the enlightened but ineffectual efforts that have been expended now these seven years past with only a retrograding effect, we are torn with conflicting emotions—on the one hand with solicitude for the future preservation of our as yet untarnished national escutcheon; on the other hand with admiration for the foreign shipping interests, and the power and influence they have been able to wield so effectually in a country foreign to their own. Out of the congressional revelations of last year it developed incidentally that the foreign shipping interests control in the main practically all the commerce between this and foreign countries, both on land and sea, by rail and steamer; and that this control is exerted by a gigantic trust, with headquarters in Germany, that kills competition by Standard Oil methods. It is understood the government has entered suit in the Court of Equity under the Sherman anti-trust law against this monopoly in the manipulation and control of the passenger business, and the foreigners have taken the ground that this government has no jurisdiction over a foreign corporation. The recent decision of the Supreme Court in the case of the Tobacco Trust, which applied the Sherman anti-trust law with full force to the two English companies doing business in this country, now renders it a foregone conclusion that the foreign shipping trust, both in its passenger and freight combines, will be ultimately dissolved as far as evidences of it are available on our shores; but it ought to be realized that, thereafter, such evidences must be necessarily very intangible and inconclusive. "The mountains have labored and a ridiculous mouse will be born." Whatever becomes of our prosecution of the foreign shipping trust, though it be actually dissolved, which is hardly conceivable, and though by such dissolution the conditions may render possible the upbuilding of competing lines, yet those conditions alone will not produce an American merchant marine, unless and until our government shall plant the seed by new legislation, and cherish and protect the plant with favorable laws. Else, the foreign grip upon our ocean shipping will remain unshaken; and to loosen it at all now will require a new birth of patriotism all over this land, sufficient to shake off this lethargy and awaken our people to a realization of their true condition of subserviency to the foreign shipping interests.

Ways and Means.

Notwithstanding the prejudice, both inspired and innocent, existing in this country against ship subsidies, it remains a fact that subsidies are the instrumentality through which existing merchant marines have been created and maintained. Subsidies and merchant marines are inseparable companions.

The constitution of the United States provides that treaties with foreign nations are a part of the supreme law of the land, and hence they cannot be set aside by a mere statute. There is now a clause in the Dingley tariff law which discriminates in favor of goods brought in American ships, but it is a dead letter, and has been set aside by the Board of General Appraisers as conflicting with our treaties. Discriminating duties must be preceded by the abrogation of about thirty treaties with foreign nations. The difficulties involved, together with the risk of retaliation, render that course well-nigh impracticable, though not impossible. Heretofore the advocacy of discriminating duties has been a means of opposition and of procrastination; with the present composition of Congress, however, it becomes not only a possibility but a live proposition. It is quite conceivable

(Continued on page 68.)

Clearing the Ocean Highway

The Derelict Destroyer "Seneca" and Her Work

By Walter Bernard

OF all the perils which beset ocean navigation, perhaps the most insidious, because the most elusive and difficult to guard against, is the derelict—the abandoned and almost submerged, but still floating wreck. When a vessel of stout construction, particularly if she be built of timber, is loaded with a cargo that is lighter than the water, she may sink until she is in the awash condition, and, by virtue of the strength of her hull, may hold together for many years, floating hither and thither at the caprice of wind and tide, and so constitute a perpetual menace to navigation. The ever-shifting wreck is naturally uncharted; and although a vigilant watch by day may suffice to detect the danger, in the night time the obstacle is quite invisible, and should it lie in the direct track of a ship a collision is unavoidable.

Unquestionably the floating derelict has been answerable for not a few of the unexplained losses of staunch and well-found ships, instances of which are too many and well known to need any recapitulation here.

The endurance of the derelict and the extent of its ocean wanderings are almost unbelievable. Take the case of the Norwegian bark "Crown," lumber-laden, which was abandoned in a supposedly sinking condition in mid-Atlantic on December 26th, 1909. In the following May it was reported as on the edge of the Sargasso Sea, and at a later date it was sighted upon the other edge of the sea, having traversed in the interval eleven hundred miles. In the summer of 1910, it was sighted between Charleston, S. C., and Bermuda.

Take, again, the case of the "Fannie E. Woolston," which was wrecked on the Jersey coast October 15th, 1891. During the following three years the wreck was frequently sighted; once off the coast of Africa, and later on the opposite side of the Atlantic, off the coast of Florida. Finally it dropped entirely out of sight.

Lloyds, of London, has developed an effective system for tracing ocean derelicts, and whenever one is sighted in any of the seven seas, it is reported to headquarters, and means are taken to intercept and destroy it.

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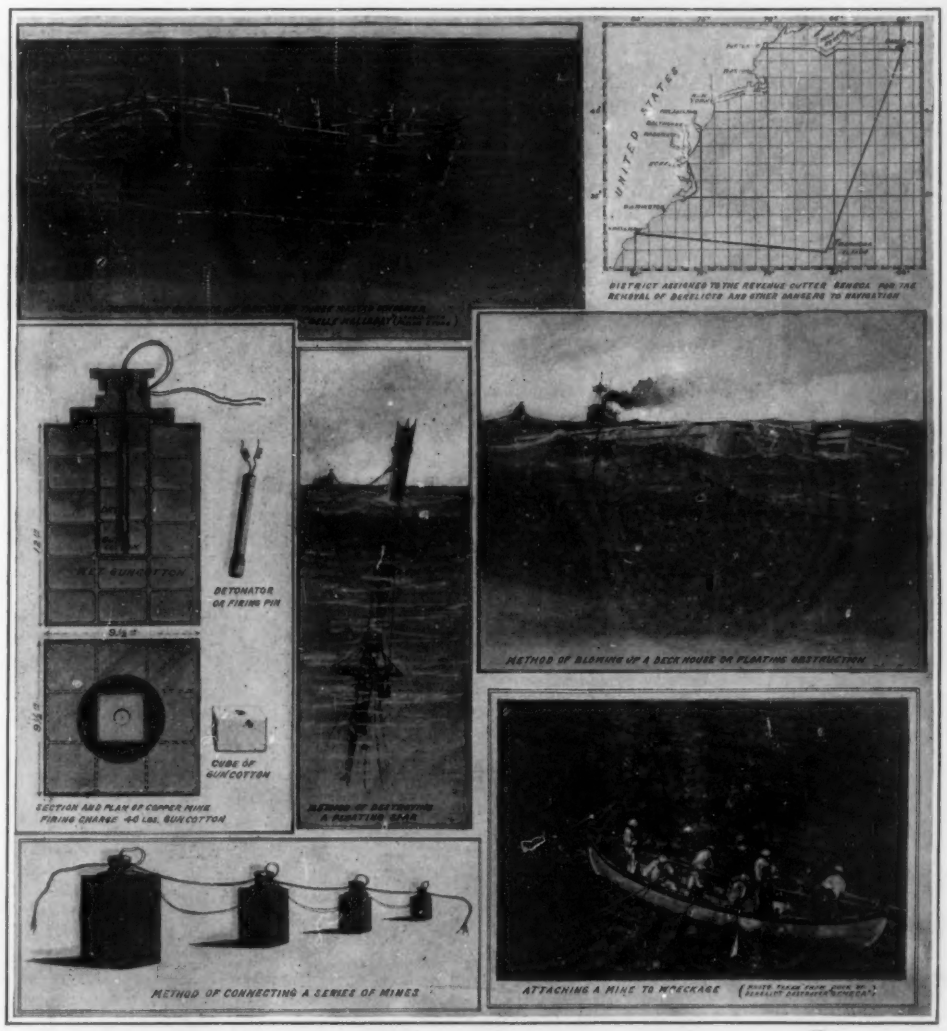
We present a series of engravings showing the methods adopted by the "Seneca" in destroying derelicts and floating wreckage. The explosive used is guncotton, which is carried in boxes, and is charged into copper canisters (mines) which measure 9½ by 9½ inches, by 12 inches in height. Each mine is loaded with 50 cubes of guncotton, each measuring 3 inches by 3 inches, by 2 inches in height, which are snugly packed within the canister, in the manner shown. In the center of the canister is a copper case containing a firing charge of dry guncotton, within which is a primer of fulminate of mercury, which is electrically detonated. Cables lead from the primer up through a threaded cap, beneath which is a rubber ball which, as the cap is screwed down, is compressed against the cables and forms a watertight joint. Rubber gaskets also serve to make a tight joint for the main cap which closes the top of the canister. A battery is used for firing. The canister as shown above is standard for all explosions, as many of them being used as is necessary to do the work.



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To illustrate the destruction of a large sunken vessel, we show the blowing up of the wreck of the three-masted schooner "Belle Halliday," which when loaded with paving stones was sunk on Pollock Rip Slue. The hulk was lying across the tide. To destroy this wreck a series of mines (canisters) was slung on a continuous cable, which was hung between two boats. The boats were rowed into a position alongside the wreck, with the cable stretched between them. The cable was then lowered to the bottom, when it was swept by the tide in under the bilges of the ship, in a position favorable for doing its work. The firing cable was then paid out to a distance of about 800 feet and the whole charge detonated. The ship was literally torn to pieces. For the destruction of the smaller floating obstacles such as deck houses, it is generally sufficient to suspend a single canister beneath the object, in the manner shown in one of our engravings.

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Bacteria as Indicators of Soil Acidity

THE longer a soil is used for producing crops, the more acid it accumulates. As most cultivated plants cannot thrive in an acid soil, it becomes necessary to employ larger and larger quantities of lime for neutralizing the increasing soil acidity. It thus becomes desirable to have a convenient method for determining the acidity of agricultural soils. The chemical methods heretofore used are cumbersome and unsatisfactory.

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Designing and Constructing an Ocean-going Steamer

How the Form, Size, Speed, Engine Power, etc., of an Ocean Steamer are Determined

By W. A. Dobson, Naval Architect William Cramp & Sons Ship and Engine Building Company

IT is the intention in this article to deal with the design and construction of an ocean steamer, as near as may be, from the viewpoint of a layman. To tell how the successive operations of design and construction are carried on, without entering into an explanation of the more or less abstruse principles involved.

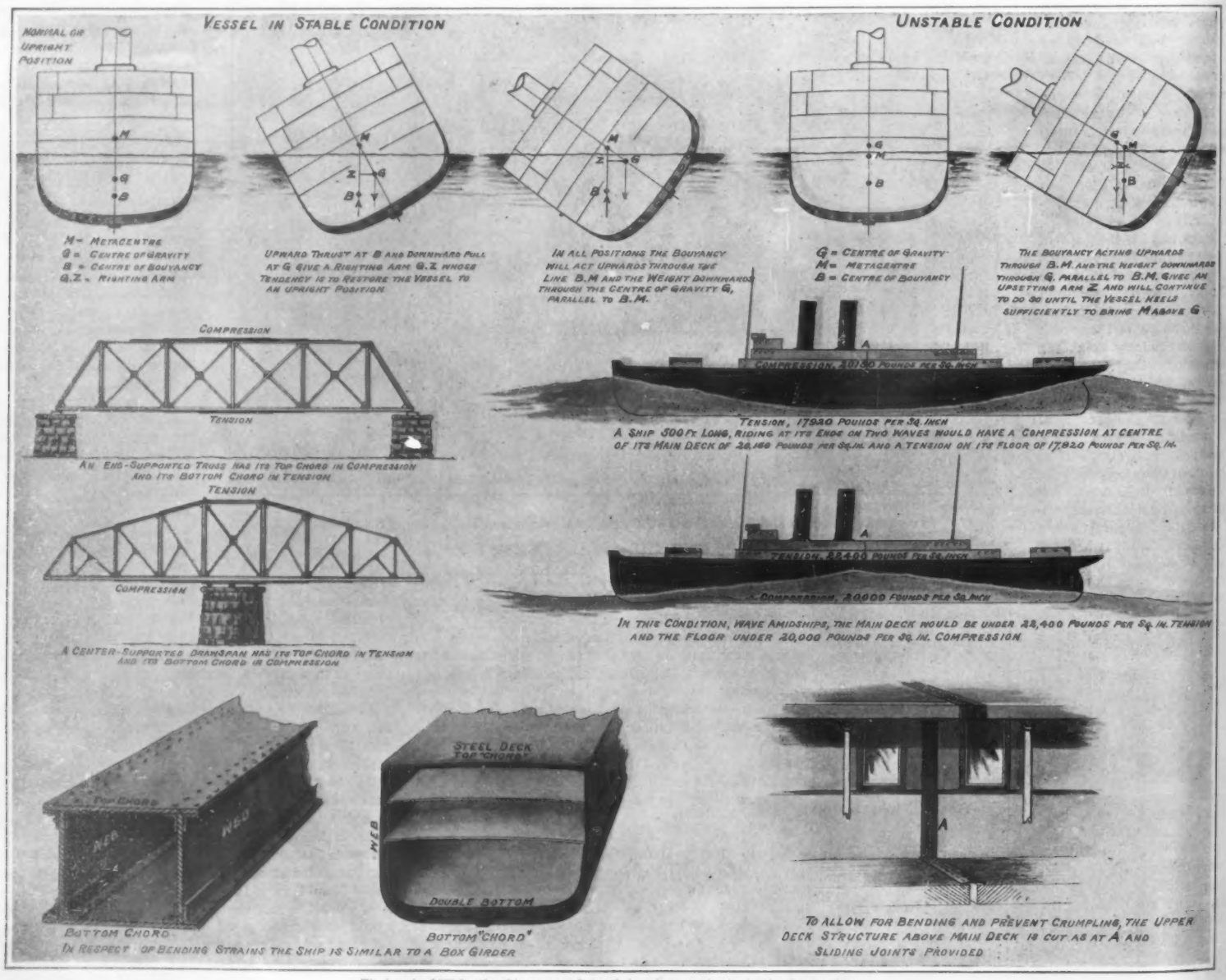
The starting point is of course the requirements of the owners. Every steamship line has its own traditions, practices and customs which must be adhered to. There are, however, certain fundamental requirements which determine the size and character of the vessel. First among these is the deadweight, or, in other words, the amount in tons of cargo alone to be carried, and its general character. Next comes the number of passengers in the first and second classes and in the steerage, for whom quarters must be provided. Then the speed necessary to maintain a given schedule between the ports of entry, and the length of route covered, in order that an adequate supply of fuel may be carried. The facilities and character of the terminals must also be considered, not only from the standpoint of handling the cargo properly, but often from the fact that the depth of water obtainable must determine the very important feature of the draft of the vessel. Another feature of great importance to the welfare and comfort of the patrons of the line is to so design the vessel as to suit the climatic conditions of the route. Having this information, therefore, given us, we are ready to approximate the displacement of the vessel in the light and fully laden conditions. It is evident that the displacement of the vessel, or its weight, at a given draft must be equal to the weight of the hull with all its equipment and outfit; the machinery and all its auxiliaries; the weight of the passengers and necessary stores; plus the weight of the fuel, and the weight of the cargo carried on that draft.

It remains, then, to determine the dimensions of the vessel and the power required, in order that the weight of the hull, machinery and fuel may be accurately calculated. For reasons given above the draft is fixed, leaving two dimensions, or the length and beam, which may be varied according to the conditions to be met. For a given speed there is a length below which it is not desirable to go, it being essential to obtain the most economical expenditure of power in driving the vessel. On the other hand, if this limit of length is largely exceeded the skin friction is greatly increased. To obtain the necessary room for passenger accommodations and capacity for cargo, it often happens that this limit must be exceeded, and the resulting increase in resistance accepted. Upon the breadth, or beam, depends largely the initial stability of the vessel, or the quality of remaining upright in still water. The safety of the vessel, therefore, fixes the minimum beam to which we may work.

We find, then, a limit in length and in beam below which it is extremely undesirable to go. It may very well happen, however, that these minimum dimensions will not give the necessary displacement or the fineness of form desired. It is then that the experience and skill of the naval architect must be displayed in arriving at dimensions which afford the necessary volume, seaworthy qualities and form of least resistance.

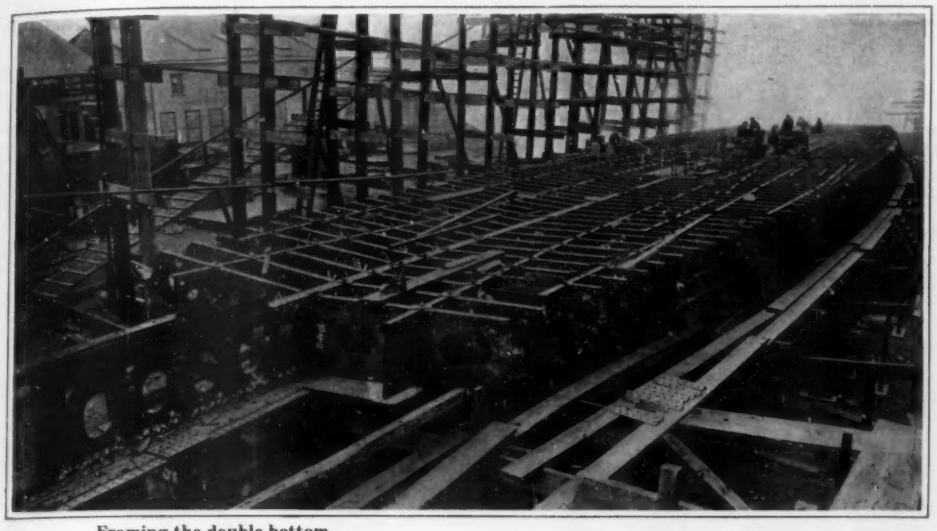
There is still another factor to be considered, and that is the depth of the vessel. The proportion of depth to beam and length affects the strength of the vessel in a marked degree. The structure for purposes of strength must be dealt with as a girder wherein the decks form the top flange and the keel, longitudinals and bottom plating the bottom flange, the side plating forming the web of the beam or girder. It can readily be seen, then, that the strength increases as the square of the depth. Under any circumstances, however, the depth must not be less than the draft plus the amount of freeboard required by the registration societies, or the freeboard necessary to comply with the Plimsoll markings. Should it be necessary to classify the vessel in one of the registration societies it may be necessary to modify the dimensions slightly to obtain a more economical arrangement of structural material, as the scantlings or the plates and shapes entering into the structure, are determined by certain rules governed by functions of length, breadth and depth.

Having settled upon the dimensions and practically upon the displacement, or within such limits as may readily be taken care of by a slight variation of the block coefficient, as the measure of the fineness of form is called, we enter upon a careful determination of the power necessary for the required speed. In all shipyards of experience extending through a score or so of years, power and speed data taken from voyages and trial trips have been carefully recorded and tabulated. These cover a great variety of forms and types of vessels. Selecting from this source the data pertaining to a ship similar in form and proportions to the vessel under design, we are able by applying Froude's law of comparisons to arrive at



The length of 500 feet for ship supported at ends is only approximate, for the stresses given.

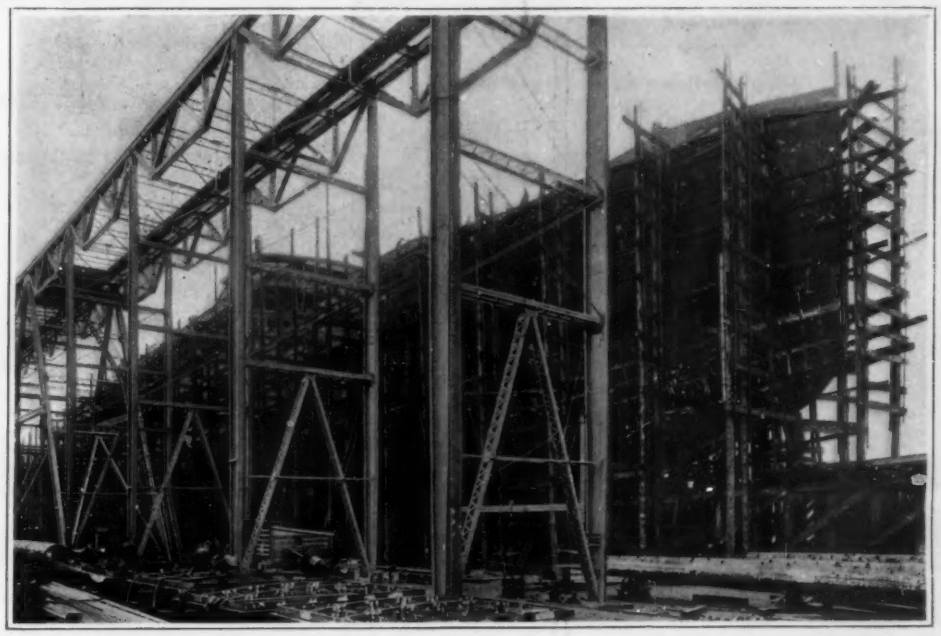
PROBLEMS OF STABILITY AND OF THE BENDING EFFECTS OF THE WAVES



Framing the double bottom.

a very close approximation of the power required; so near, in fact, as to settle the weight of machinery and amount of fuel needed and thus finally fix the exact displacement. The plans of form, or, as commonly called, "lines," are then prepared, embodying the designer's best judgment as to the most suitable underwater form to give the least resistance. The "lines" are then sent to one of the experimental model basins, one of which is owned and controlled by the Government at Washington, and the other by the University of Michigan. Here a model is made from them, and its towing resistance at varying speeds carefully recorded and plotted. From the model resistance the effective horse-power for the actual vessel is calculated. The result of the model experiment is the final word in so far as the power required is concerned. If the result is not satisfactory to the designer he will prepare another set of lines and try them, or make such changes as a careful observation of the model under test may indicate will lessen the resistance. When finally satisfied he may rest secure from all apprehension of a trial failure caused by insufficient power.

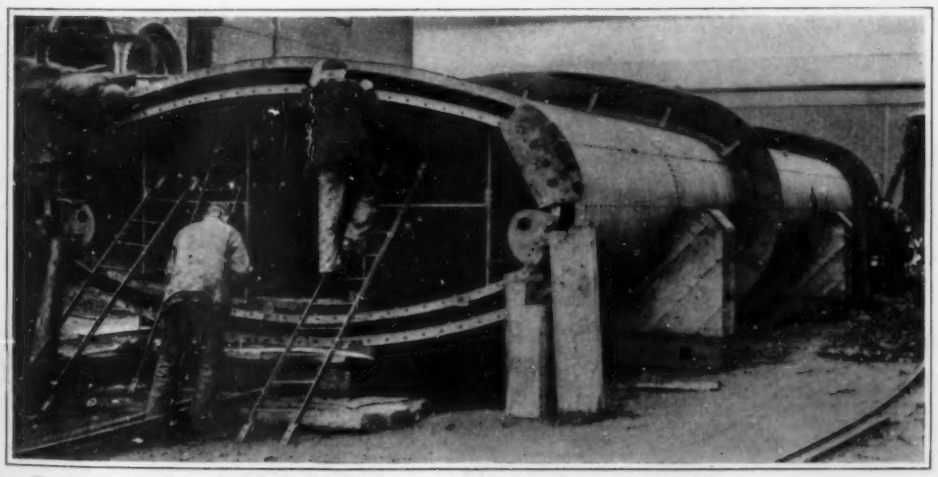
Three more qualities of the ship as a whole remain which must be investigated, and they are the strength, trim and stability. Most vessels are built



The ship in frame and plated.

The trim of the vessel depends of course upon the relative positions of the center of gravity of the completed vessel, and the center of gravity of the immersed volume, or the part of the vessel in the water, commonly called the center of buoyancy. Both must lie in the same vertical line, and the vessel will necessarily assume such drafts as will satisfy this condition. To maintain a predetermined draft line it is necessary, therefore, not only to accurately estimate the total weight, but its longitudinal center of gravity as well. This must be done before the plan of form or "lines" is made, in order that the center of buoyancy may be properly located. Ordinarily, when fully laden, the vessel trims on even keel and by the stern when light

There remains still the important feature of stability to be investigated, for upon the condition of stability depends largely the safety of the vessel. It may be said that there are three conditions of stability or equilibrium in a body floating freely in still water, and these are stable, unstable and neutral. It is absolutely necessary to obtain the first of these conditions, and it depends solely upon the position



The inner ring shows funnel, the outer ring the casing.

An elliptical funnel.

of two points, one known as the transverse metacenter and the other the vertical center of gravity of the completed ship. The metacenter depends upon the geometrical shape of the underwater body, and the center of gravity upon the arrangement of the weights that enter in the *tout ensemble* of the vessel. The distance between them is known as the metacentric height. If the center of gravity is too far below the metacenter, the vessel is too stiff and quick in rolling, making her extremely uncomfortable for her passengers, and if too small a distance is maintained the vessel is liable to be unstable. A reasonably small metacentric height, combined with high freeboard, whereby a long range of stability is obtained, is found to give a safe, slow and deep-rolling vessel, with the maximum of comfort to those on board.

There is still another condition of stability to

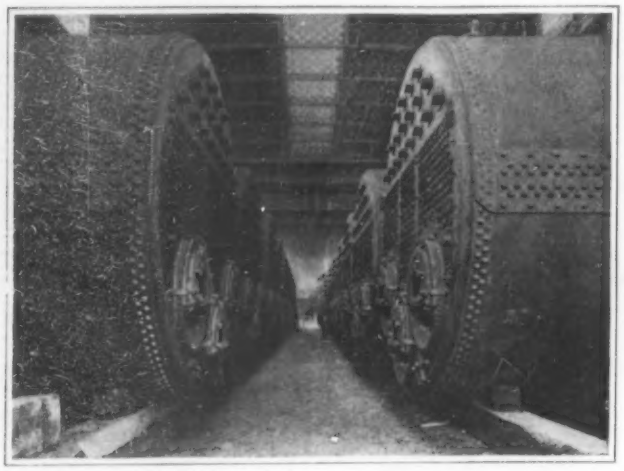
to be classed in some one of the registration societies, and where built according to their rules, if of the general type of construction provided for, very little apprehension need be felt regarding the strength. Occasions frequently arise, however, when a new form of construction is required to suit some particular type of vessel. It then becomes necessary to calculate the stresses coming upon the top and bottom flanges of the girder, when the vessel is either upon the crest of a wave or in the hollow, the wave chosen being of the same length as the vessel. In all conditions of the sea the vessel itself, considered as a loaded beam, remains practically the same, but the points of support are constantly changing. On the crest of a wave we have the beam supported in the middle with ends free, and in the hollow, the ends supported and the middle with little support. The estimated stress is arrived at only after complex and laborious calculations of too technical a character to be here described.

By driving in wedges the weight of the ship is transferred from the permanent to the launching ways.

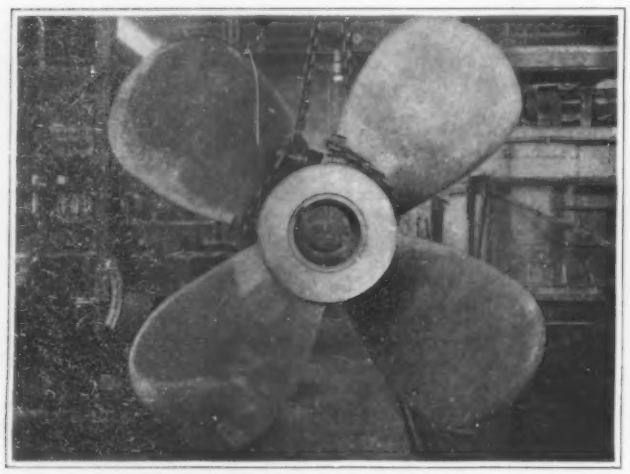
Wedging up preparatory to launching.

provide for, and that is when by accident the compartments at the ends of the vessel are flooded with water, the change in trim shall not be so great as to submerge the upper watertight deck. This is provided against by the arrangement of the bulkheads at the extremities of the vessel, so as to keep the weight of water admitted and its free surface as small as practicable.

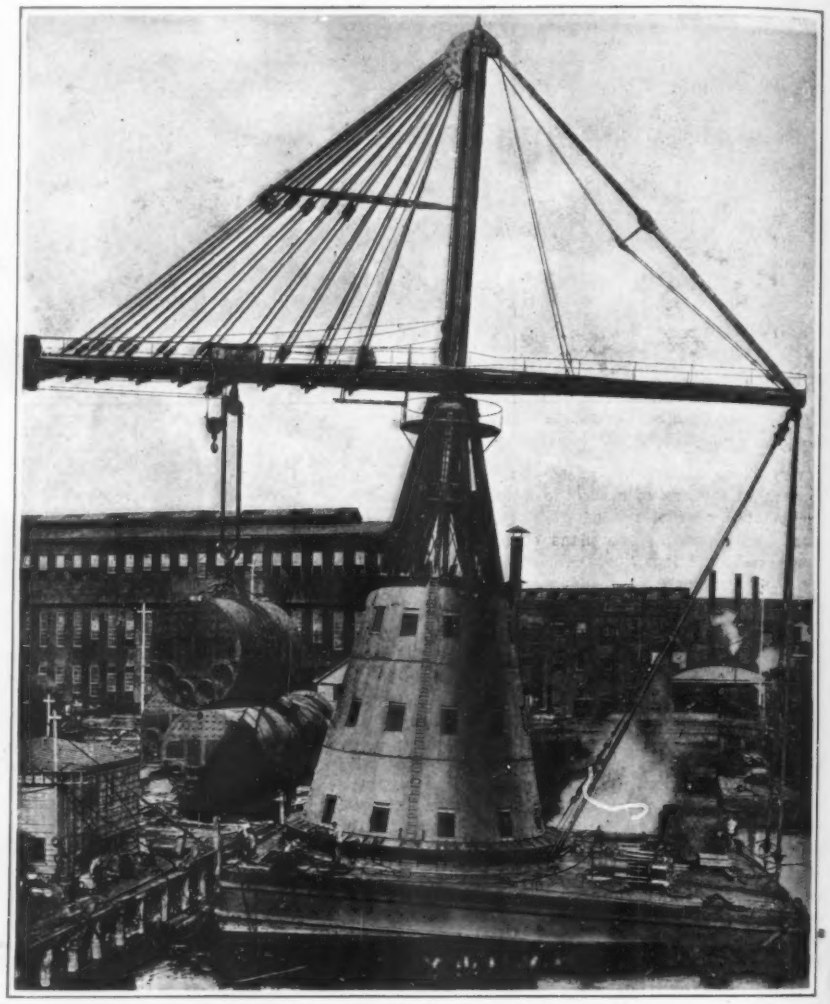
Almost all seagoing merchant vessels of the better class are fitted with Scotch boilers, arranged for heated forced draft. The motive power, however, is one that admits of careful study, the type chosen being governed largely by the wishes of the owners. For vessel over 20 knots per hour speed, the later-day tendency is, where vessels are running at



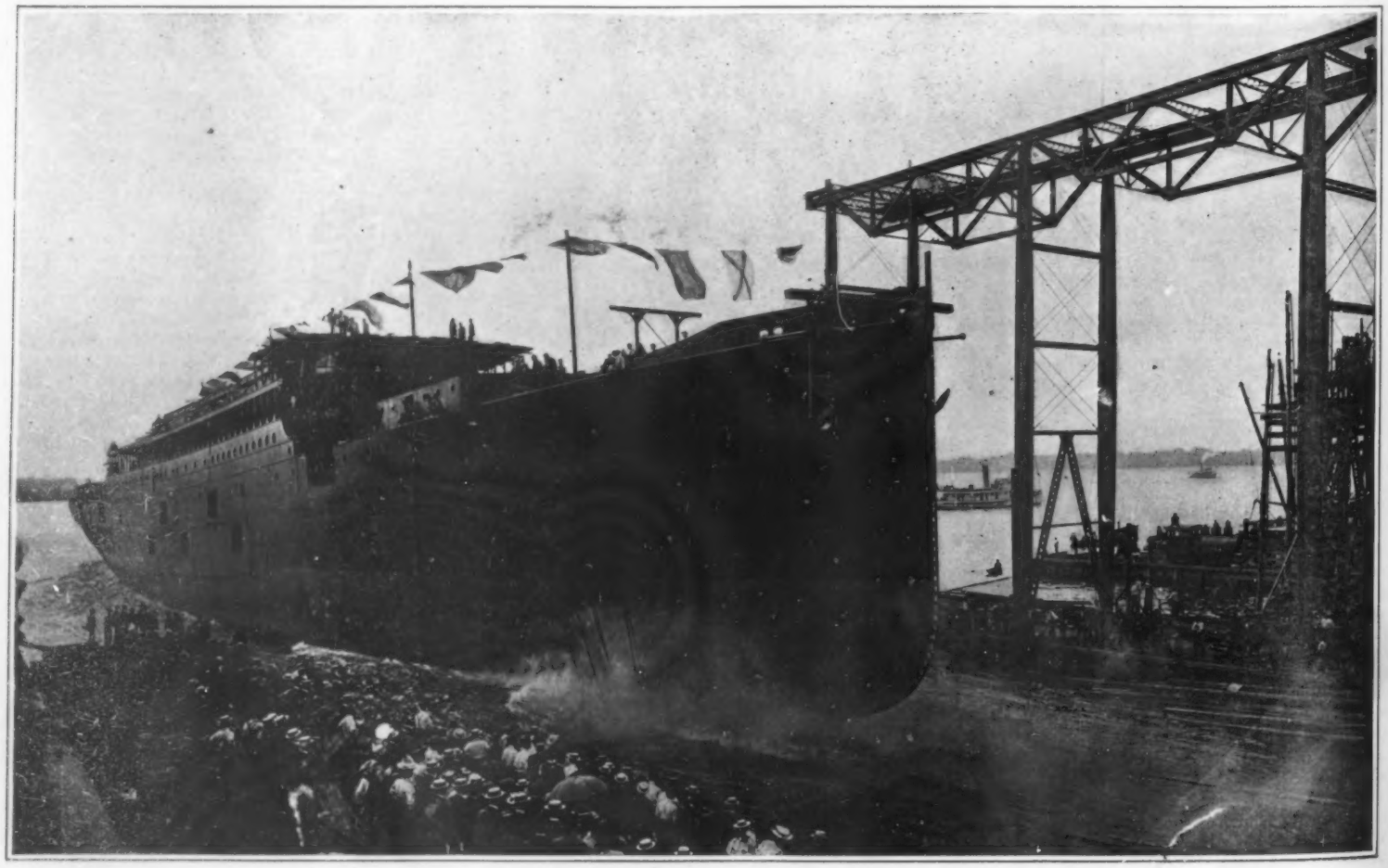
This Battery of boilers was placed in the Olympic



Propeller ready for keying on shaft.



Floating crane transferring a boiler from wharf to ship.



The launch of a large steamer

DESIGNING AND CONSTRUCTING AN OCEAN-GOING STEAMER

full speed, day in and day out, to arrange for steam turbines, although many owners stick to the old and well-tried triple expansion reciprocating engines. An excellent and most economical arrangement is a combination of reciprocating engines for the higher steam pressures, combined with a turbine for the lower.

Having settled upon the dimensions and form of vessel, the type of machinery and the accommodations for the passengers, we are ready to proceed with ordering the material and getting the work in the yard. To this end plans of all the structure of the vessel are made, from which the material is measured and orders sent to the mills. Drawings of the machinery are prepared, from which the patterns and forgings are made, and to which the different parts as furnished are finished in the shops.

The lines of the vessel are laid down full size on the floor of the mold loft from which the shape of each frame is taken. The frames come into the yard from the mills in straight pieces, which are heated and bent to the shape given by the molds. Molds or templates conforming to the shape of each frame and paper templates are made in the loft, from which the material as it arrives in the yard is laid off and planed and punched ready for erection and riveting.

The first step in the yard is to prepare the keel blocks for the reception of the keel. As almost the entirely weight of the vessel up to the time of launching must rest upon these blocks, they must be of very substantial character, and should be laid upon piles with cement or timber caps so to prevent any settling of the blocks. As the vessel, when sufficiently finished, must be transferred from the building slips to the water, the blocks are laid with an inclination from the bow to the stern, to facilitate launching.

The next step is to lay the keel and the bottom plating, up to the turn of the bilge or beyond the margin plate of the inner bottom. Then the frames and the longitudinals within the double bottom are erected, and plated over with the inner bottom plating. The side frames and stringers and the stem and sternpost are then erected and the bulkheads placed in position; then the beams are also placed and we are ready to put in place the side and deck plating. Meanwhile the engine, boiler and shaft foundations have been built and the stern tubes and propeller struts secured in place. The rudder is now ready for hanging and the vessel is so far completed as to be ready for launching.

This is one of the most interesting processes in building, for we have to transfer from the keel blocks to the water a structure weighing in some instances from twelve to fifteen thousand tons. Since the vessel as built rests upon the keel blocks and shores, it is necessary to raise the vessel up clear of them, and at the same time transfer the weight to a platform capable of being moved at will. The method generally used is to place on each side of the keel blocks a runway formed of heavy pieces of timber, made smooth on the upper surface, and framed together. The breadth is such as to support about two and a half tons per square foot of area when the weight of the vessel rests upon them. These timbers, called "ground-ways," are laid upon piled foundations parallel to the keel, and about one-third of the vessel's breadth apart. They extend from the bow down into the water sufficiently to have at least nine feet of water on their ends at high tide, and are set at a slightly greater inclination than the keel blocks. When these ways are in position and properly braced and shored, their upper surfaces are coated with tallow and grease about five-eighths of an inch in thickness. Upon the greased surfaces are placed a similar set of ways free to move, when released, called "sliding-ways." These extend as far forward and aft as the form of the vessel will permit. On top of the sliding ways and between them and the ship's structure a cradle is built conforming to the ship's form in the line of the ways. Between the cradle and the sliding ways a multitude of long wedges are placed, which when driven up gradually raise the vessel from her building blocks, so that the weight rests upon the two greased surfaces, and is only held from moving by a heavy tie at the forward end of the ways, or a releasing trigger fitted with a hydraulic cylinder to throw it out of gear at the proper time. If a timber tie is used holding the sliding into the ground ways, it is sawn asunder, and then the vessel is free to move down the greased inclined paths to the water.

During the construction of the steel hull, work on the engines and boilers and joiner work has been pushed in the different shops so that the vessel as soon as launched is ready to receive her machinery and auxiliaries, and to have the passenger accommodations carried along to completion.

The passenger accommodations include in their scope a small unit of almost all the plants common to a large city. A water supply and drainage system must be provided; an electric plant capable of operating auxiliaries and thoroughly lighting the vessel is necessary; a ventilation system whereby fresh air is carried to all parts of the living quarters is provided; a refrigerating and cold storage plant must be provided for the preservation of fresh meats and vegetables, etc. In addition, all the conveniences fitted in a first-class hotel find their counterpart in an ocean liner. There must be a laundry, with drying rooms, etc., all machinery for laundering; dish-washing machinery; a kitchen complete with ranges, boilers, steamers, broilers, warming tables, hot tables, meat-chopping and meat-slicing machines; bakery; printing office; a bar and wine room; public and private baths; barber shop; music rooms; library; lounging and smoking rooms. In the first-class quarters a great field is open to the art of the decorator, who, in many instances, has produced notable examples of taste and proportion.

All of these details must receive the care and attention of the builder, from the day the keel is laid until the vessel leaves his hands ready to start on an ocean voyage.

Space forbids going into detail in connection with the appliances fitted and means provided to insure the safety of the passengers against fire, collision, or explosion. Suffice it to say that each one of the dangers to be encountered is provided against in the most thorough and reliable manner, insomuch, in fact, that a large, up-to-date ocean steamer is about the safest place in which a person can be—though not to all people the most comfortable.

Correspondence

Observations of a Wheat Student

To the Editor of the SCIENTIFIC AMERICAN:

The writer is doing some experimenting in wheat growing that may prove of great scientific interest to the agricultural world along the lines of intensive wheat culture.

Fifty feet from my bedroom window (I am a shut-in crippled by a severe colotomy operation) I had planted a plot, 8 feet square, with six kinds of autumn wheat. The soil was good but hard-pan underlay it, giving me but 24 inches of growing earth. A problem arose as to moisture sufficient to grow the wheat and sufficient plant food containing earth to nourish it. I met the problems, and I see my wheat waving in the breeze, "heading" nicely and *above the 6-foot measuring rod.*

Liebig used human nitrates as a fertilizer, and increased the gluten in growing wheat from 10 to 31 per cent. A proposition of tremendous human economic interest when you think that a lean steak has but 20 per cent of animal "gluten" in it. Flour at 3 cents per pound; steak at 25 to 30 cents per pound.

I am using human nitrates in the fertilizing of this wheat. The growth is phenomenal; now it remains to be seen what the analytical chemist will find when the ripened kernels are sent to his laboratory.

My theories are these: That with intensive culture (not the hit or miss trust-in-Providence methods now in use) and the proper fertilizers, our wheats can be intrinsically improved in a muscle-food building sense, and the *yields* greatly increased as well.

Lezinsky, so states the *Nova Vremyea*, grew from *one* wheat kernel planted at the apex of a funnel-shaped pit, 24 × 18 inches deep, lightly covering with earth the growing stem repeatedly until it reached the surface, 19,523 stalks of wheat, each bearing its quota of kernels! Phenomenal stooling. As the *Nova Vremyea* is a sedate Russian journal, not given over to *Punch* or *Puck* joking, one does a little thinking. Prince Kropotkin got, it is stated, 150 bearing stools from one kernel of wheat so growing. I am now to try out this "pit" experiment.

We are "up against it," agriculturally speaking, when our national wheat crop averages but 13 bushels as against England's intensively farmed wheat with a yield of 32 bushels, and North Dakota's average last year of 4½ bushels.

If my 8-foot farm yields a very high protein content in the wheat, and the fertilizing value of human nitrates can be duplicated in a commercial fertilizer, in a practical economical way, there is room ahead for scientific research as to applying better ways and means of producing our staff of life. The very thought of increasing the food value in a loaf to twice or thrice its present state leans somewhat toward a reduction in the higher cost of living, for then man could, if he had to, live and live well and be perfectly nourished on "bread alone," upsetting the Biblical contention to the contrary.

As my experiments progress, I may write you. I am doing what I can to exploit the soap trees of Mr. Moulie of Jacksonville, Fla., in California. A most useful and valuable tree seemingly.

Point Loma, Cal. CHARLES CRISTADORO.

Advantages of Forward Horizontal Rudders

To the Editor of the SCIENTIFIC AMERICAN:

"Surface winds are well known to be oscillatory in character, i. e., subject to rapid variations of pressure, velocity and direction, altogether analogous to sound waves." (Page 422, SCIENTIFIC AMERICAN.)

"The 'Canard' was practically the same machine with the body lengthened 5 meters in order to bring the horizontal rudder that much farther forward of the planes. The above experimental glider, which was tested at Berck-sur-Mer when Voisin was experimenting with Capt. Ferber, was instrumental in giving the former the European record of duration as a glider." (Page 424, SCIENTIFIC AMERICAN.)

Superiority of the horizontal rudder forward aeroplane being demonstrated but not analyzed in your article, I suggest the advantage of the horizontal rudder forward as a sustaining device is that it automatically lifts the front of the machine every time a gust strikes it, and has the main planes inclined upward before they are struck by the gust. Similarly, it drops the front when the velocity of wind ceases. This seems a step in favor of prolonged gliding flight without engines. Practice in observing velocities and skilled adjustment of the forward horizontal rudder may bring us much nearer our dream of flight on so-called "sound waves."

I would suggest that experiments of this nature be made over the water for safety, horizontal position of aviator to reduce air resistance, and for the assistance the aviator would receive in seeing the gusts on the water before they struck his wings. Assistance might be rendered from a boat with a string and reel, thus making the practice prolonged.

Gliding is generally attempted on calm days for safety. It should be attempted on gusty days for power. Birds seem unable to glide any considerable distance on a calm day, except on conditions where an upward local current is found. Such currents must be often formed on calm days on account of the sunshine warming the lower atmosphere.

Denton, Md. J. FRANK GELLETLEY.

Dotted Guide Lines

To the Editor of the SCIENTIFIC AMERICAN:

In book catalogues and price lists, and elsewhere, I have noticed the use of lines of dots, the purpose of these being to guide the eye from the thing to the number or price thereof. For example:

Bravo	C777-2
Afloat and Ashore	C777
Miles Wallingford	C777-15
Les Miserables	H895-3
Ivanhoe	S431-14
Redgauntlet	S431-22
Apples	40 cents
Eggs	30 cents
Potatoes	55 cents
Coffee	30 cents
Tea	65 cents

Since the lines are close together the eye is often confused and fails to pursue a straight course in passing from the thing to the number. In order to assist the eye in keeping the line, and to increase the efficiency of the dots, I suggest the omission of every other line. For example:

Bravo	C777-2
Afloat and Ashore,	C777
Miles Wallingford	C777-15
Les Miserables,	H895-3
Ivanhoe	S431-14
Redgauntlet	S431-22
Apples	40 cents
Eggs,	30 cents
Potatoes	55 cents
Coffee	30 cents
Tea	65 cents

When the names and numbers are far apart, and especially if the type is small and the spacing is close, it may be well to retain only every third line.

Buffalo, N. Y. ALFRED J. MILLER.

Abstracts from Current Periodicals

Phases of Science as Other Editors See Them

Whale Meat as a Food

IN a recent number of the *National Geographic Magazine*, Mr. Roy Chapman Andrews, Assistant Curator of Mammals of the American Museum of Natural History, wishes that the European and American people could be educated to the point of eating whale meat, or, as he puts it, "canned flesh of animals yielding as much as 80,000 pounds of meat." This, it seems, is the point which Japan has reached—a country where thousands too poor to buy meat content themselves with whale flesh.

It was the invention of the harpoon gun in 1864, by a Norwegian, Swend Foyn, that rendered this great supply of meat possible, Mr. Andrews assures us:

"With the further development of the harpoon gun grew up a new and great industry, for it made possible the capture of a group of whales known as rorquals, or finners, in sufficient numbers to warrant the erection of stations at certain points on the shore where the animals could be brought in and the huge carcasses converted into commercial products. Previously these whales had been little troubled by the men who hunted in a small boat with a hand harpoon and lance, for the great speed of the animals and their tendency to sink as soon as killed, as well as their thin blubber and short, coarse baleen, made them unpopular with the early whalers.

"In a few years stations had sprung up on the coasts of Norway in every available place, and later reached across the Atlantic to the American shores. Newfoundland became the first hunting ground for the whalers here, and only a few years ago as many as eighteen stations were in operation on that island and the immediate vicinity.

"The great success of the Norwegian methods attracted so much attention that stations were erected in every part of the world where conditions were favorable—in British Columbia, Southeastern Alaska, Bermuda, South America, and the Islands of the Antarctic; on the coasts of Japan, Korea, Africa and Russia. Australia is soon to be invaded, and only a few months ago a company announced their plans for carrying on operations on a large scale in the Aleutian Islands."

In New Zealand, hump-back whale are being taken in wire nets, and so in nearly every part of the globe the world-hunt goes on. The inevitable result of this wholesale slaughter will be the commercial extinction of the large whales within a very few decades, according to Mr. Andrews.

The marvelous rapidity with which the enormous carcasses are handled and cut up is described by Mr. Andrews:

"A heavy wire cable was made fast about the posterior part of one of the whales just in front of the tail or flukes, and the winch started. The cable straightened out, tightened, and became as rigid as a bar of steel. Slowly foot after foot of the wire was wound in, and the enormous carcass, weighing perhaps forty-five tons, was drawn out of the water upon the slip.

"One of the Japanese (for men of six nationalities—Chinese, Japanese, Norwegians, Newfoundlanders, Indians and Americans—are employed at these west-coast stations) scrambled up the whale's side, and balancing himself on the smooth surface by the aid of his long knife, made his way forward to sever at the 'elbow' the great side fin, or flipper, 16 feet in length.

"Before the carcass was half out of the water other cutters, or 'flensers,' as they are called, had begun to make longitudinal incistons through the blubber along the breast, side and back, and from the flukes the entire length of the body to the head. The cable was then made fast to the blubber at the chin, the winch started, and the great layer of fat stripped off exactly as one would peel an orange. When the upper side had been denuded of its blubber covering, the whale was turned over by means of the 'canting winch,' and the other surface flensed in the same manner.

"The blubber is a layer of fat of varying thickness which covers the entire body of all whales, porpoises, and dolphins, and keeps the animal warm. It acts exactly as the feathers of birds or the hair of land mammals—as a non-conductor to prevent the natural heat of the body from being absorbed by the water in the one case, and the air in the other. On the great bowhead, or Greenland right whale, which lives in the intensely cold waters of the Arctic Ocean, the blubber is twelve or fourteen inches thick in some places.

"When the 'blanket pieces,' as the blubber strips are called, were torn from the carcass, they were cut into large oblong blocks and fed into a slicing machine, clipped to small bits, carried upward and dumped into enormous vats, to be boiled or 'tried out' for oil.

"The carcass had meanwhile been split open by chopping through the ribs of the upper side, a heavy hook was attached to the tongue bones at the throat, and the entire mass of heart, lungs, liver and intestines drawn out at once. The body was then hauled to the 'carcass platform,' at right angles to the 'flensing slip,' the flesh torn from the bones, and the skeleton disarticulated.

"Both flesh and bones were piled separately into great open vats which bordered the carcass platform, and boiled to extract the oil. The flesh was then artificially dried and sifted, thus being converted into a very fine guano, and the bones pulverized to form 'bone meal,' also a fertilizer. Even the blood, of which there are several tons in a large whale, was carefully drained from the slip into troughs, boiled, dried, and made into guano. Finally, the water in which the blubber had been tried out was converted into glue.

"The baleen, or whalebone, which alone remained to be disposed of, was thrown aside, to be cleaned and dried as opportunity offered. The baleen of all the rorquals is short, coarse and stiff, and in Europe and America has but little value. In Japan, however, it is made into many useful and beautiful things."

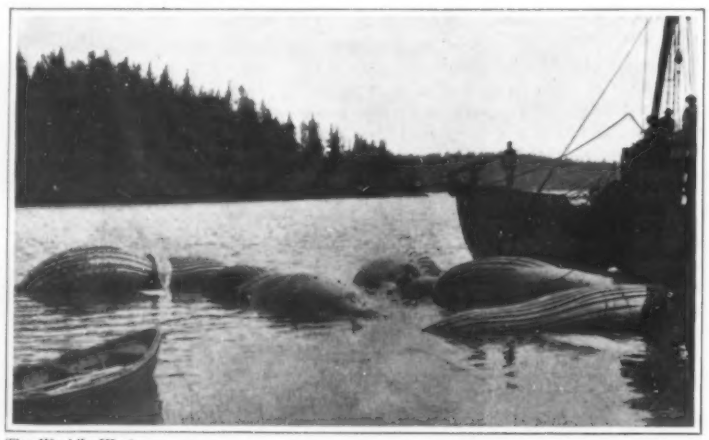
This, with the exception of minor details, is the method of handling whales which the Norwegians developed after years of experimenting, and which is followed in almost all other parts of the globe except Japan.

The Japanese apparently surpass all other nations in using the carcass of the whale to the utmost. Not only have they extracted the best there is in the whale and adapted them to their peculiar needs, but they have added much to their experience which whalemen of other nations would do well to recognize, Mr. Andrews believes. "Too poor to buy beef, the diet of many Japanese along the coast would include but rice, fish and vegetables, were it not for the great supply of flesh and blubber furnished by these huge water mammals. In winter the meat of the humpback whale, which is most highly esteemed, sometimes brings as much as 30 sen (15 cents) per pound; but this is unusual. Ordinarily it can be bought for 15 sen or less. But the edible portions are not only the flesh and blubber. Certain parts of the viscera are prepared for human consumption, and what remains is first tried out to extract the oil, then chipped by girls using hand knives and

The harpoon as it strikes the whale.

In addition to the rope, the harpoon carries a bomb, which is exploded three or four feet inside the whale and usually kills the huge animal instantly. The black cloud is the smoke from the discharge.

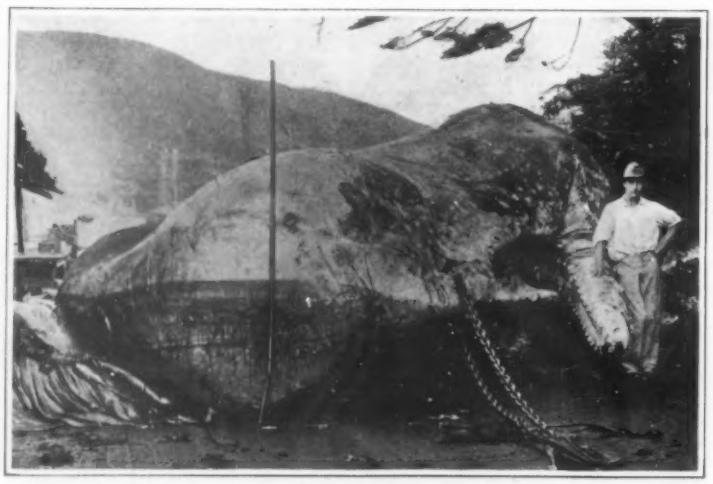
Towing the inflated whale to the factory.



The World's Work.

The carcasses of five humpback whales: Vancouver.

This whale is considerably smaller than the blue whale, its maximum size being 55 feet.



Head of the 60-foot sperm whale sent to the American Museum in New York: this head yielded 20 barrels of spermaceti.

Photographs by courtesy of the *National Geographic Magazine.*

dried in the sun for fertilizer. Whale meat is very coarse-grained and tastes something like venison, but has a flavor peculiarly its own.

"I have eaten it for many days in succession," says Mr. Andrews, "and found it not only palatable, but healthful. The Japanese prepare it in a variety of ways, but perhaps it is most frequently chopped finely, mixed with vegetables, and eaten raw, dressed with a brown sauce.

"In the summer, when it is impossible to ship the meat to any distance because of the heat, much of it is canned. The flesh is cooked in great kettles, and the cans made, packed and labeled at the stations. On my desk, as I write, is a tin of whale meat which I brought from Aikawa, where hundreds of pounds were packed and sent southward to be marketed at Tokyo and shipped to all parts of the empire."

Battle Practice in the American Navy as an Example of Efficiency

PROBABLY the most marvelous and valuable example of standardized operations anywhere in the world is on our American fleets in battle practice;" so states Mr. Harrington Emerson, the efficiency engineer, in the *Engineering Magazine*. "The art of war has not changed as to its fundamentals since men first began to fight on land or sea. The purpose is with a stronger force to overwhelm a weaker opposing fleet—to strike first, hardest and quickest. It was Goliath's idea to pick off the Israelites one by one, and a modern pugilist could defeat a hundred men if they charged him singly, and he could down the first before the second came up. A 'Dreadnought' makes all the navies of the world without 'Dreadnoughts' obsolete, because such a battleship with its ten 12-inch guns can fire a broadside from all of them at once while steaming at 21 knots.

"Such a battleship steaming as fast as any rivals, bringing more guns into action than any rival, hitting an enemy at seven miles, could destroy the whole of an opposing fleet one by one, even as the pugilist would take the lighter weights one by one. But the horse-trotting, fire-fighting American stop-watch practice is also in the navy, and it was realized that if these big guns could be fired four times as fast, it would be very nearly the same as having four times as many guns or four times as many 'Dreadnoughts;' and also that if the skill of aim could be increased four-fold, if four shots would reach the target as compared to one in the older practice, one modern 'Arkansas' or 'Wyoming,' with twelve 12-inch guns, firing four times as fast and hitting four times as often, will, for the time being at least, be sixteen times as effective. These big guns are loaded, aimed, and fired twice in a minute. The practice drill is only half this time, and this practice drill is of two kinds. There is the physical act of loading the heavy gun, there is the more important act of pointing it. Two opposing ships are 10,000 yards apart (about six miles) steaming at 18 knots in diverging directions. The rate of change of range may be 750 yards a minute. If the range is set for every 50 yards, it must be redetermined every 4 seconds. This is impossible, but it can be determined every 30 seconds and a salvo be fired every 30 seconds. Being able to determine the range twice a minute, to fire twice a minute, the remaining part is drill in pointing or aiming, and this is done by means of much practice with models.

"To hit a target 60 feet wide and 30 feet high at 30,000 feet with a big gun, when you can cover it twice over by the point of a lead pencil at arm's length, is considerably harder than to hit a target 1 inch high at 83 feet with a small gun; but it is much better and much cheaper to fire 1,000 shots with the small gun than to fire the big gun once; and when the big gun is fired four times in practice, after training with small apparatus, it will do better than if firing 100 real shots without the model practice.

"In the battle practice I saw the first 12-inch range-finding shot, from a distance of 14,000 yards, go clean through a 30 by 60 target; and so accurate and secure was the aim of all the salvos that we calmly watched the shots splash all around the floating target only 400 yards away. The firing end was not less impressive. The team work was so perfect that the salvos from the same ship were redirected one after the other almost with the ease with which a child swings a garden hose.

"I have also watched diminutive and juvenile Igorot savages shoot dimes from a forked stick at 60 feet with bow and arrow. The Igorots show us the beginnings of offensive skill; modern American battleship target practice shows us the highest speed, accuracy, and distance yet attained, and we may not doubt that our present achievement is but a step in man's ultimate achievement.

"The improvement in the effectiveness of the different ships of the navy in the last five years is very great, and is probably the greatest improvement both in importance and magnitude that has ever been accomplished. Think of the small degree to which the steam turbine is superior to the reciprocating engine (a questionable 5 per cent), or how very little faster the best passenger trains are than the slowest of the same class (about 25 per cent). Think of the enormous expense in time and money spent in developing either steam turbines or high-speed trains; then think of the sixteen-fold increased efficiency of our battleships as compared to five years ago, an increased efficiency due to the application of the principles of efficiency—*all of them*—Ideals, Common Sense, Competent Counsel, Discipline, the Fair Deal, Reliable and Immediate Records, Schedules (of 10,000 yards), Dispatching (of big shot at the rate of ten or twelve a minute), Standardized Conditions, Standardized Operation (secured by constant and assiduous team drill), most minute Standard-Practice Instructions (as to how fifths of seconds can be saved in time); finally, a joyful and much coveted Efficiency Reward, in both honor and emolument, when the tremendous results have been accomplished. And when this appears not only in the spectacular gunnery, but also in the more prosaic but continuously important operations of firing coal; of coaling ship (the record as to this having increased from 30 tons an hour to 360 tons an hour on some of the ships for the whole cruise around the world); of the maintenance of operation of machinery on board ship without going to navy yards—these accomplishments show that high efficiency requires neither great outlay nor protracted time but only the proper intelligence, spirit and organization. The seagoing form of organization is admirably adapted to apply the principles, since a gun drill, a coal drill, a recoaling drill, is but a practical and modern form of drill. The ideal is not a mere dress parade, but to hit accurately, fast, and furiously, at the greatest distance, an enemy's ship overtaken by better management throughout; and this ideal has been accomplished stop watch in hand, refining all the conditions and operations, this refinement made possible by bringing to bear all the available knowledge in the universe. This navy work is a great game, not drudgery; it is pleasurable excitement and joyously hard work."

Good Roads and the Motor Truck

THE experience already accumulated with the motor vehicle has abundantly demonstrated that one necessary feature to its successful use is good roads. There are few existing types of motor vehicles capable of carrying large loads which can compete as yet with the 10 or 20-mule team on the Western plains. That there are possibilities in this direction will certainly be admitted, and some manufacturers are already working in this direction; witness the "Caterpillar" traction engine recently illustrated in these columns and the farm tractor.

In the opinion of the *Engineering News*, it must be said that the motor vehicle is at present confined to good roads. "When it strikes a soft spot or a slippery spot, it has an uncomfortable habit of digging a hole and burying itself with a promptness that would make any ground-burrowing animal known to zoology ashamed of its feeble efforts.

"An excellent exemplification of the dependence of motor trucks upon good roads is furnished by the experience of an enterprising truck manufacturer who last fall sent a 5-ton truck to make a journey from Denver to Los Angeles, loaded with 3½ tons of lumber.

"It took 68 days to make the journey of 1,519 miles from Denver to Los Angeles, an average distance of about 22 miles per day.

"The journey was made," the *Engineering News* presumes, "to demonstrate the ability of the truck to pass unscathed over the roughest and most unpromising territory. What the demonstration really showed, however, was that if the truck or any other vehicle of similar construction is to be operated at a profit, it must have reasonably decent roads to run on. Judging by the official accounts of the trip which were given out, the load of lumber was pretty well worn out during the journey through its frequent use ahead of the truck to carry it across soft spots in the road.

"Such freight hauling by motor vehicle may be good advertising but it is not good business. In fact it is extremely doubtful whether any vehicle weighing as much as four or five tons with its load can be profitably run over soft dirt roads.

"The advent of the commercial motor vehicle is interesting to highway engineers from two points of view. In the first place it will enormously increase the demand for good road construction. In the second place it will likewise enormously increase the wear and tear upon road surfaces. Perhaps this is the most important engineering problem of all those presented by the advent of the motor vehicle.

"As every engineer engaged in highway construction knows, the advent of the pleasure automobile has revolutionized our whole problem of highway construction, has practically doubled the cost per mile of permanent macadam roads and has probably much more than doubled the annual cost of maintenance. It has been hoped by the engineers who have most to do with road problems that a fairly satisfactory solution has been reached through the use of the latest and best forms of bituminous macadam involving an increased expense in construction and maintenance about as outlined above.

"If, however, as seems not only probable but certain, we are in the near future to add to our present heavy passenger automobile traffic the traffic of heavy motor trucks, carrying loads of two to eight tons and propelled at speeds reaching 20 miles an hour or higher, what sort of road surface can the engineer provide that will stand the wear, and yet not exceed the taxpayers' limit of elasticity? We shall not attempt to answer this question. We doubt whether any one is wise enough to answer it now; but it is one that will have to be answered in the near future.

"Sooner or later, the heavily-burdened taxpayer is certain to raise a protest at the enormous burden imposed upon him for road maintenance. Sooner or later, conservative sentiment will awaken to the foolishness and wickedness of unloading upon posterity the burden of paying for good roads which are destined to be worn out long before posterity arrives. Sooner or later, we must place upon the owner of the automobile the burden of paying for the wear and tear which his machine produces upon the roads.

"The fool propaganda of good road enthusiasts has widely disseminated the notion that good roads are cheap to build and once built cost little to maintain; and this notion has caused a vast amount of trouble for engineers.

"It is important that the public should understand that good roads cost money and a lot of money to build and to maintain, and that with the advent of the commercial automobile their cost per mile for both construction and maintenance is likely to be materially greater in the future."

The Adventitious Arsenic in Fruit

THE use of Paris green as an insecticide on fruit trees has been pretty generally abandoned because of its solubility and the consequent injury to fruit and foliage. The substitution of arsenate of lead has been on the whole more satisfactory, although, as P. J. O'Gara points out in *Science*, a careful examination has shown that this substance is not altogether without objectionable features. In the preparation of arsenate of lead by the combination of either the nitrate or acetate of lead with disodium arsenate, there are formed three distinct lead arsenates in varying proportions. The ortho-arsenate, $Pb_3(AsO_4)_2$, is practically insoluble in neutral or alkaline water, and so quite harmless. But the meta-arsenate, $(PbHAsO_4)_2$, is commonly very injurious; and the pyro-arsenate, $Pb_2As_2O_7$, may become so when the water used contains in solution chlorides, sulfates or carbonates—which means practically all common waters.

In addition to burning or spotting of leaves and fruit, varying quantities of the arsenic are absorbed. Chemical analyses showed this amount to vary with the degree of spotting. In some spotted apples the skin showed, in a 10-gramme sample, as much as 0.05 milligramme of arsenic; in a single apple there was a total of 0.3 milligramme.

The presence of arsenic in the paper used for wrapping the fruit for shipping is also a source of danger. The writer refers to one shipment of pears from the Pacific coast, in which all the fruit came from one orchard and was treated exactly alike, two different kinds of paper being used. When taken from storage one-half was much farther advanced in ripening than the other, and the difference corresponded to the presence of arsenic in the paper. That arsenic hastens the ripening process has been known for some time.

The writer warns fruit growers about the quantity and the composition of the arsenate of lead used in spraying, and about the brand of paper used in wrapping the fruit.

Bent by the Sun

THE towering Washington monument, solid as it is, cannot resist the heat of the sun, poured on its southern side on a midsummer's day, without a slight bending of the gigantic shaft which is rendered perceptible by means of a copper wire, 174 feet long, hanging in the center of the structure, and carrying a plummet suspended in a vessel of water. At noon in summer the apex of the monument, 550 feet above the ground, is shifted, by expansion of the stone, a few hundredths of an inch toward the north. High winds cause perceptible motions of the plummet, and in still weather delicate vibrations of the crust of the earth, otherwise unperceived, are registered by it.

The Inventor's Department

Simple Patent Law; Patent Office News; Inventions New and Interesting

Development of Ore-handling Machinery

THE development of ore-handling machinery in connection with ore transportation on the Great Lakes is a good mechanical illustration of the doctrine of the survival of the fittest. The millions of tons of ore accumulating in the

George W. Hulett, who has introduced a number of important innovations in machinery for handling materials.

Lake Superior region have to be transported to their lake destination during a period of not to exceed eight months in each year. Here, if anywhere, time has been the "essence of the contract." One type of apparatus has replaced another almost as soon as its mechanical and time-saving advantages have become apparent.

Every development in ore-handling machinery has been based on two ideas, namely, that of increasing the speed with which the ore is handled, and that of reducing the cost. The work divides itself naturally into two distinct operations, the loading and the unloading. The problem of loading the ore into the boats has been a simple one—gravity suggests an obvious solution, and some form of elevated bin and chute is everywhere used. Unloading, however, has always been a more difficult proposition, and has furnished a fertile field for the exercise of the inventive faculty. It is the object of this article to touch briefly upon a few of the types of devices which have been used from time to time for this purpose, and to conclude with a short description of the two leading types of machines now in use.

Originally the ore was shoveled into a bucket or tub, which was hoisted and swung around by an ordinary crane. The bucket was dumped into a traveling lorry or car located on an elevated track, and when the car was filled, it was taken to the stock pile and dumped. In a few years the single crane and bucket gave way to a battery or set of cranes all operated by a common hoisting machine. Crude and uneconomical as this apparatus is, it is still in use to a limited extent.

About 1880 Alexander E. Brown of Cleveland, O., and others, brought forth the first examples of the now well-known "unloading bridges." The prime advantage of the unloading bridge, in its early form, was that by it ore could be distributed over a large area. It also dispensed with the lorries or cars used in the previous construction.

The first unloading bridge consisted, essentially, of two towers or piers traveling on tracks laid parallel with the docks; a cableway joining the towers; an apron or boom pivoted to the front tower and projecting over the water; and a bucket-supporting carriage or trolley traveling on the cableway. The bucket was hoisted and its travel controlled by means of a cable or cables which led to a hoisting machine located in the rear tower.

Within a few years the cableways were generally replaced by rigid trussed trackways. These trackways usually extend beyond the rear tower to afford a larger travel of the bucket. However, the cableways are still used to a limited extent in places where the installation is to be used for a short time only.

It is desirable to so arrange the bridge that it may be slewed through an angle of fifteen or twenty degrees with respect to the track. Special pivots, allowing for both vertical and horizontal swinging motion, are therefore provided between the trackway and each of the supporting towers; and the bridge is propelled along the tracks by separate independently operable motors, so that either tower may be moved without moving the other.

It is also desirable that the apron or boom may be movable to and from working position without interfering with the rigging of the boat. This has been accomplished principally in two ways: First, by means of a telescopic track-end which may be projected or retracted horizontally, and, second, by providing the boom with rollers at its inner end, which rollers travel up and down a vertical trackway on the front tower, the outer end at the same time being supported by guys. This arrangement causes the outer end of the boom to be projected and retracted along a line that is nearly horizontal.

In the bridges recently constructed, the hoisting drums are mounted on the traveling carriage or trolley. This carriage also supports an operator's cab from which point all motions of the unloading bridge are controlled by a master controller. The special advantages of so mounting the drums and cab are that it avoids the use of long traversing cables, and places the operator in a position from which he can see and accurately direct all movements of the bucket.

The usual length of the unloading bridge is from 180 feet to 250 feet, but bridges are in use in which the track length exceeds 500 feet. Those at the Indiana Steel Company's plant at Gary, Ind., are 495 feet long, and the towers are spaced 187 feet from center to center. The usual height of the track above the yard is about 60 feet. The power used to operate the Gary bridges is as follows: To open and close the bucket, four 80 horse-power motors; to traverse the trolley, four 40 horse-power motors; and to move the bridge, four 30 horse-power motors.

The type of device by which the bucket has been hoisted and transported is one invention, the particular form of bucket, another; and they have not developed hand in hand. During the life of the crane-and-bucket unloader and for several years after the advent of the unloading bridge, the buckets in use comprised the combination of three elements: The bucket body; the supporting bail, which was pivoted to the bucket body at a point below its center of gravity when filled; and a latch connecting the bail and bucket body. When the latch was released the bucket was reversed and dumped by the weight of the load. The great disadvantage of this type of bucket is that it is not self-filling at least not when used with ore. Probably the most arduous and man-killing work connected with the ore-handling industry is the shoveling of the ore into the buckets. It is slow, dangerous and costly. This condition led to the invention and development of the grab or clam-shell bucket, which may be said to have been one of the most important steps in the whole ore-unloading art.

This bucket, in its simplest form, comprises, as is generally known, two co-operating halves or jaws pivoted together, and a means for opening and closing them. The means employed may be a drum and two chains or cables, in which instance the drum is mounted on the

A. E. Brown, the originator of the "unloading bridge."

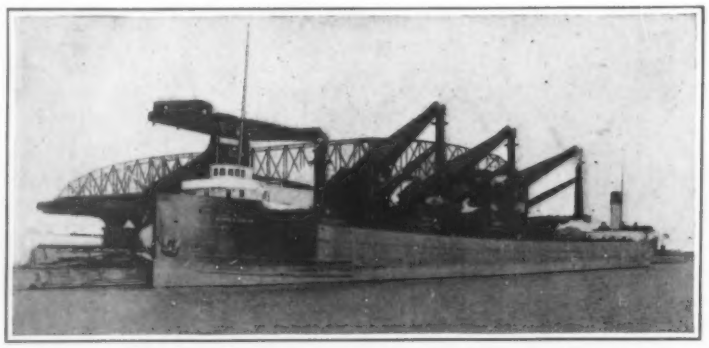
pivot, or on a frame supporting the pivot, with a chain or cable connected to each of the bucket-halves. In another type toggle levers are substituted for the drum and chains. The bucket is usually supported by two cables. When suspended by one of the cables the jaws are held open by the weight of the bucket itself; when supported by the other cable they are automatically closed. In the operation of the grab bucket it is held open and allowed to drop jaws-down, which causes it to become partially imbedded in the ore. The other cable is next hauled in, the result being that the jaws are closed. The bucket is afterward hoisted. Upon reaching the dumping point, it is again suspended by the opening cable, and the material is discharged.

The capacity of the clam-shell used in unloading bridges varies from 5 to 15 tons. Ordinarily it does not exceed 7½ tons. It is said that bridges equipped with 5-ton buckets will unload on an average about 200 or 250 tons per hour. The buckets are designed to make from 60 to 70 trips per hour, and consequently, it is not unusual to handle 350 tons per hour during the first part of the unloading of a ship.

The cost of operating these bridges, considering also interest and depreciation of plant, is said to be about five cents per ton of ore unloaded.

The clam-shell unloader, however, has this disadvantage, namely, there is no weight, other than that of the bucket itself, to force it into the material. The bucket also swings to an undesirable extent. To overcome these defects, a later type of unloading machine—that invented by Mr. George W. Hulett of Cleveland, O. was designed.

This machine comprises the following elements: A gantry bridge traveling on tracks laid parallel with the dock; a carriage traveling to and from the dock-front on girders which connect the legs of the gantry bridge; a pivoted walking beam supported by the carriage; a vertically extending leg pivoted to the end of the walking beam; a link or equalizer pivoted to the carriage and to the leg and co-operating with the walking beam to cause a parallel motion of the leg; and a grab bucket connected rigidly to the lower end of the leg. The leg may be

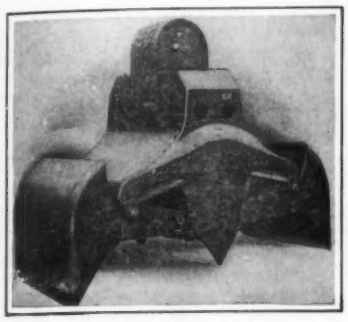


A battery of four Hulett grab buckets unloading coal from a large steamer.

Plant of "Brown" standard bridge tramways at Cleveland, Ohio.

rotated by a cable and bull-wheel to extend the bucket in any direction.

In operating this machine the whole device is propelled along the track until it is opposite the hatch from which ore is to be taken; the carriage is run out on the gantry bridge until it is over the ore, after which the bucket-leg is lowered, it being brought positively to loading position by the combined action of the walking beam and the connecting link; the bucket is then closed about the ore, the motion of the walking beam reversed, the carriage backed, and the bucket dumped.



The "Brown" grab-bucket.

Since the moving parts are very heavy—the whole machine weighing about 460 tons where a bucket having a capacity of 10 tons is used—it is essential that the movement be reduced to the lowest possible limit. For this purpose and in order to save time, the gantry bridge is provided with a second pair of tracks, upon which a traveling hopper is supported. These tracks are extended as a cantilever at the rear of the bridge. The bridge itself straddles four ordinary railroad tracks. Consequently the hopper may be dumped into a car on any one of these tracks or run out on the cantilever extension and there discharged into a stock pile.

The control of the various motions involved is an important consideration. One operator rides in the bucket-leg close to the bucket, and has control of the hoisting, lowering and rotation of the leg, and the opening and closing movements of the bucket. Another operator directs the movement of the carriage, of the hopper, and also of the machine along the dock. The controllers, proper, for all these motions, are located near the respective motors, and are in turn controlled by small drum controllers located at the operator's stations.

The following data are given concerning the power used by the Hulett unloaders at Gary, Ind.: To open and close the bucket, 80 horse-power; for operating the walking beam, 150 horse-power; for moving the carriage, 50 horse-power; and for operating the hopper and propelling the whole machine along the track, 75 horse-power; total, 355 horse-power.

When equipped with 10-ton buckets (the usual size), each machine frequently unloads 500 tons per hour, making the capacity of each unit about 500,000 tons per season, working days only. Four steam-operated machines at Conneaut, O., have averaged 403 tons per hour on a 7,000-ton boat, and the maximum taken out by a single machine in an hour was 631 tons.

Don'ts for Air-brake Inventors*

DON'T forget that successful invention is not a pastime nor a subliminal uprush, but an evolution from long experience, painstaking observation, careful analysis, intimate familiarity with the varying requirements and local conditions in all parts of the country, thorough knowledge of mechanics and the laws of nature (not the least important of which are embodied in the M. C. B. rules of interchange and the rulings of the Interstate Commerce Commission), a severe disregard of non-essentials and of repeated failures and an unfailing persistence, born of optimism, the courage of proven conviction, and hard, common sense.

Don't confuse invention and financiering. To invent is not synonymous with "to get rich quick."

Don't assume a parental attitude toward an invention. Fatherly sensitiveness and solicitude only add a sting to failure, while real merit will need only the backing of cold, hard facts to substantiate its claims.

Don't be satisfied with yourself or your first or even last idea of a device. Look for the defects, not the merits in any design you propose to patent. The latter will always take care of themselves. An apparent success, however, is oftentimes more fatal than flat failure. The latter at least tells the truth and usually teaches a valuable lesson; the former raises false hopes and obscures the truth and results in a corresponding greater failure when the final reckoning does come.

Don't forget that there are always two sides to every question, especially in the case of a mechanical device. None are so bad as not to have some good points. On the other hand, the merits of a device may be many and important, and yet its patent value worthless on account of non-interchangeability, too great refinement, previous patents covering the same idea, and so on.

Don't expect to get something for nothing. Whenever such appears to be possible it will surely develop that the net gain is worth exactly the price paid, namely, nothing. Stored energy can be made to perform useful work only by a transformation from a higher to a lower level, by a progression from the concentrated to the diffused, never in the reverse order. The process of converting the energy in a pound of coal into available form as live steam is on a descending scale, never at 100 per cent efficiency nor anywhere near it. Again, the conversion of the energy of steam into available drawbar pull at the tender is attended by still further losses. These examples are but typical of every process by which mechanical work is performed. No mechanical system can be operated at 100 per cent efficiency; at best it only approximates this figure under the most favorable conditions of the laboratory.

Don't mistake "possibility" for "practicability." Many things are possible, but only a few are practicable.

Don't think because a really practicable device can be designed to perform some function, that it deserves to be universally adopted. To deserve attention this function must be distinctly useful and more; it must be definitely and unqualifiedly on the side of increased safety or economy of operation.

Don't attempt to find a remedy for a known defect by getting around the effect, but first discover the cause and overcome that.

Don't mistake the troubles which come from careless and improper handling or laxity in inspection and maintenance for inherent defects in the apparatus; these troubles require betterment in instruction or maintenance, rather than improvement in design.

Don't expect to find road and laboratory conditions the same. They are not.

Don't be surprised if a device which works perfectly (?) on a test rack proves unmanageable in a service test. Dirt, abuse, misuse, neglect, water, frost, heat, over-lubrication—all are in favor of such a difference.

Don't overlook existing apparatus and conditions.

Don't forget that in the air-brake any failure in function of any part must be in the direction of safety—not of danger. In other words, a failure must cause the brakes to apply—not to release or prevent a brake application when one is attempted.

Don't think because a device will operate satisfactorily in itself that it will meet with instant and unqualified success. For example, the electro-pneumatic brake is an ideal system for long-train service, and was so acknowledged in the official report of the M. C. B. Burlington brake trials. ("The best type of brake for long freight trains is one operated by air and in which the valves are actuated by electricity.") But it is not and probably will not for some time be adopted in steam-road freight service on account of fundamental mechanical, practical, and economic considerations, the force of which is patent to anyone familiar with what such a change would involve.

Don't forget that the millions of dollars of capital already invested in existing equipment prohibit the introduction of any device which will not work in perfect harmony with the apparatus now in use under every conceivable condition of service.

Don't allow mechanical ingenuity to obscure the limitations imposed by the laws of pneumatics and mechanics or considerations of practicability and economy.

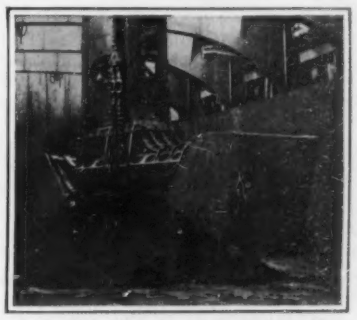
Don't think that an air-brake device stands alone. Not only is it affected by surrounding conditions and other devices with which it is associated, but it in turn also affects to a greater or less degree all other members of the system in which it operates.

Don't place too great faith in the results obtained with a single device or under a single fixed set of conditions. Railroad conditions demand that air-brake appliances work as well on a 50 or 100 car train as on a single car and under the most unfavorable as well as favorable conditions. Many devices and systems will work marvelously well alone or in short trains or under favorable laboratory conditions and yet be totally unfit for long-train or mixed service or subject to fatal disarrangement or entire failure when exposed to neglect, extremes of weather or careless handling.

Don't neglect friction. Usually there is more friction than can be conveniently provided for at every point in the brake apparatus, except where it is most needed, viz., between the brake shoe and wheel. Here there is seldom enough.

Don't assume that air can move instantly. Air has inertia and requires times to change from a state of rest to motion.

Don't consider air as being without friction. The friction between a moving column of air and the walls of the pipe or passageway in which it moves may be considerable, and prodouctive of unexpected and disconcerting results when not properly allowed for. For example, it has already been shown that with the triple valves cut out the brake pipe may be left wide open at the front end of a 100-car train, and instead of an instantaneous drop in pressure throughout the length of the pipe the last quarter of the train remains at its original pressure, without perceptible drop, for fully twelve seconds. This is the result of the combined effect of inertia and friction.



One of the Hulett grab-buckets of the battery shown unloading a steamer.

Don't spend time, money, or energy upon devices which depend for their proper operation upon different rates of rise of brake-pipe pressure. Back of the first 25 or 30 cars the difference between a high or low excess pressure or the use of release or running positions of the brake-valve handle can barely be detected by the most delicate recording apparatus.

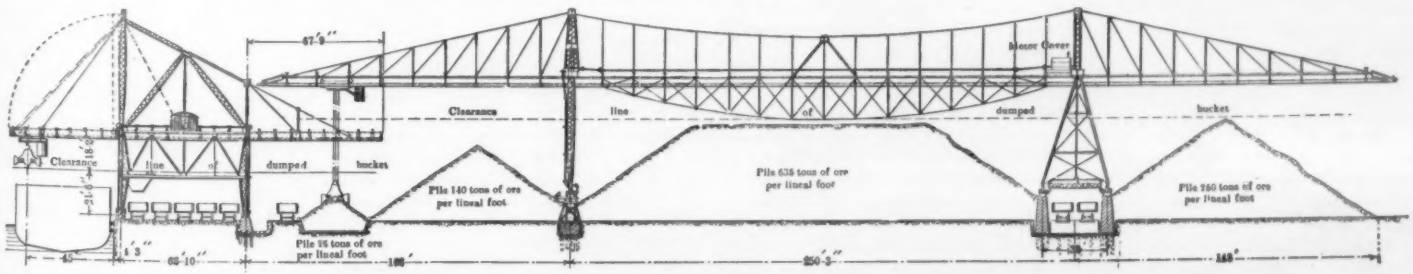
Don't overlook the variability of the human equation. As long as there is any possibility of mishandling or wrong manipulation, it will surely be found, for there are a thousand ways in which a thing may be wrongly done and but one right way. It is for this reason that "fool proofness" takes high rank among the prime essentials of all air-brake devices.

Don't overlook the fact that simplicity, interchangeability, fool proofness, and low first and maintenance cost often have more to do with the success of a device than ingenuity of design or nicety of construction.

Don't fail to consider the economic features of any device which is to be proposed for patent. Safety and protective features being equal a net gain in dollars and cents must be shown over and above the rating of the apparatus to be displaced or added to before any excuse can be offered for even considering a change.

Don't consider the ordinary materials of manufacture indestructible. The results of wear must be foreseen and provided for if the apparatus is to be practicable.

Don't expect to accomplish results by



Diagrammatic view of a "Brown" unloading plant and storage bridge at the Pittsburg & Conneaut Dock Company, Ohio.

*Abstracted from the Third Annual Report of the Block Signal and Train Control Board to the Interstate Commerce Commission.

means of large supply reservoirs located at different points in the train to be connected into the brake pipe to assist in releasing and recharging. The danger characteristic of all such schemes, viz., an undesired release of the brakes or inability to apply them when an application is attempted is inseparable from any system in which the derangement or failure of the mechanism controlling the connection between the brake pipe and stored volume permits the brake-pipe pressure to be increased when not intended.

Don't forget that cars must be handled in yards and terminals without the brakes being coupled up and without air in the brake systems.

Don't lose sight of the fundamental functions of the brake system as a whole. No device, regardless of how perfect its individual design, construction or operation may be, can be tolerated which carries with it the possibility of interference with the normal operation of the brake as a whole.

Don't attempt to eliminate what appears to be a defect without considering carefully what effect the means adopted will have on other functions of the brake as a whole. While the desired improvement may be possible it may be at the expense of trouble in other directions of such greater moment as to prohibit the change proposed.

Don't try to cure apparent defects of design or function by the use of additional devices subject to the same or worse objectionable features. The cure is bound to be worse than the disease. Usually it can be overcome in a better manner than by the use of additional devices.

Don't expect the proposal of a novel brake system for steam-road service involving the use of two brake pipes to be received with favor by the railroads. If American railroad practice would permit of the use of an extra brake pipe, with hose connections between cars, some one of the hundreds of schemes of this sort patented from time to time would no doubt have been adopted long ago. The fact that only one brake pipe is tolerated in modern American practice, when considered along with the self-evident and sound reasons why this is the case, should be sufficient to effectually discourage further efforts in this direction. The differences between steam and electric or European service conditions are a sufficient explanation why two, or even more, air pipes have been successfully used in the latter case.

Don't forget that mechanical locking devices intended to hold the brakes applied while descending grades depend for their proper action upon such close adjustment and sensitiveness of operation and involve such a multiplication of parts that the fundamental requirement of a brake device, viz., absolute reliability, is lacking at the outset.

Don't permit any device to become associated with the brake pipe in such a way that its failure to act as intended can, by any possible chance, prevent an application of the brakes or cause a loss of the brakes, if applied.

Don't fail to recognize the brake pipe as the one and only central nerve of the air-brake system and to treat it accordingly. It is not to be furnished with attachments except under stress of positive necessity, and only then after provision has been made so that any failure on any part to perform its function will be on the side of safety and not danger. Put yourself in the place of the submarine diver some fathoms below the surface of the sea and consider what your views would be upon a proposal to ingraft various accessory devices along the air tube whose integrity spells life to you at that moment. Much the same feeling animates those responsible for the insurance of traffic stability and the safety of human lives with regard to the preservation of the functions of the brake pipe.

Don't mistake convenience for necessity. Where the necessities already tax the capacity of the system as a whole to the utmost, as is the case with the air-brake, mere convenience without demonstrable economy, either in maintenance or service operation, is not to be considered.

Don't expect to provide a satisfactory safeguard against rare contingencies by means of apparatus requiring careful adjustment, frequent cleaning, and so on, to insure its being always in proper working order. The usual result in such cases is that the protective device becomes inoperative through neglect due to fancied security and fails to work at the critical moment.

Don't think that because an idea is new to you it is new to the air-brake art. Most of the simple and practicable methods of accomplishing desirable results have been covered by patents for many years. The odds against a simple and practicable device such as railroads want and are willing to accept, being new are therefore great. As any working device is usually made up of a combination of a number of simple principles it follows that before even taking out a patent, surely before becoming enthusiastic over the value of an idea, cold-blooded skepticism will save many dollars and much disappointment later on. The very small cost of a search for previous patents related to the same idea will save valuable time and money, and in most cases convince the embryo inventor that he is far from being the first in the field. That this advice is not mere personal opinion or a desire to quench ambition's spark, but is the simple, unvarnished, but in the end merciful truth of the matter, will be acknowledged by all who have made a study of the art. It is, moreover, precisely the basis upon which all manufacturing organizations conduct their development of new apparatus. Nothing is left for chance or taken for granted. All that has been done in their line is classified and studied minutely. Thousands of dollars are spent in sifting out the old from the really new and patentable. If this is sound business policy for the large concern, with unlimited resources, how much more wise and prudent for the individual of limited means, who can not afford to spend time and money without reasonable assurance of profit.

In a word, inventing is an art of the highest type, requiring peculiar genius, training and experience, while the capacity for appreciating or foreseeing the real value of a patent is an entirely different thing, requiring quite a different sort of skill and education. Consequently even the best inventors are rarely, if ever, capable of accurately gaging the value of their own inventions from a purely patent standpoint.

Protecting an Undeveloped Patent

AN inventor is frequently confronted with the problem of protecting an invention which he has conceived, pending his perfection and completion of the improvement and at times he misses the apparent protection of a public record which at one time he was able to secure by the filing of a caveat. When an inventor conceives an invention, which is not the idea that some such improvement might be made in some way or other, for conception of an invention includes a thought of the means by which the invention may be carried out in practical form when he so conceives of an invention, he should proceed with all the diligence at his command to complete the invention into form for practical use and should use it successfully in the presence of reliable witnesses, who can be depended on to testify not only truthfully, but accurately as well, to the successful operation and construction of the device. Pending the completion of his invention, the inventor should preserve all sketches, drawings, models and descriptions, made from time to time, with the dates of making and with the signatures of reliable witnesses, with the dates of signing and should preserve all records, bills for materials and the like, so that they may be available for evidence should a contest ever occur, bearing in mind that the better his preparation for a contest, the less likely he is to experience one.

Notes for Inventors

Artificial Rain.—A method of producing artificial rain for farmers has been invented by Mr. Emilio Olsson, of Buenos Ayres, and has been copied in France and Germany. Mr. Olsson is now in this country for the purpose of introducing his invention. His system has been used with great success on an experimental farm near Buenos Ayres. One of the Olsson installations is in successful use at the Peluffo Gardens in the Calle Rivadavia, and consists of three lengths of one-inch piping, two lengths being placed at an altitude of five meters, and the third at a height of 3½ meters, in accordance with the height of the plants watered. Each length of piping is fitted with two jets of four spouts each, the effect produced is exactly that of a shower of rain. Mr. Olsson has devised a method whereby the water can be charged electrically, with the result that not only are crops greatly improved, but that insect pests are destroyed.

A New Indicator for Ships.—An English newspaper account tells of a newly invented "direction and rotation indicator" for steamships which is to be placed in the chart room and bridge and enables the navigator to see at a glance the speed and direction of the engines and number or revolutions per minute. When ordering "ahead" or "astern" at any speed the indicator instantly tells whether the order is being executed.

Tales of an Assistant Examiner.—A prominent New York attorney tells of an experience with an assistant examiner of the Patent Office, with whom, in an interview, he found it difficult to come to any definite conclusion about anything involved in the discussion. Finally, almost in despair, the attorney said: "Now," addressing the examiner by his title, "will you agree with me that this claim is either allowable or is not allowable?" and after due consideration the official gave this guarded reply: "That the claim is allowable or is not allowable. Well, for the sake of argument, I will agree that the claim is allowable or is not allowable." If all the stories that have been told of this assistant examiner, who is as generous and bighearted as he is peculiar, were gathered in a volume, the result would be some interesting and amusing reading.

Reciprocity in the Patent Office.—Reciprocity, or retaliation if you please, is found in the Patent Office rules, in the provision that any foreign patent attorney, not a resident of the United States, may be registered as entitled to represent as attorney applicants before the Patent Office if the country of which said patent attorney is a citizen grants the same reciprocal rights to citizens of the United States, and no foreign patent attorney will be recognized in any application filed after June 30th, 1908, unless his country grants reciprocal rights to our attorneys. As a matter of fact, it is thought that only three foreign nations, namely, Canada, Mexico and New Zealand, extend the privilege to patent attorneys of the United States, so that the number of foreign attorneys entitled to registration here is very limited.

The Frequency of Automobile Fires.—Is there not needed a fire extinguisher especially adapted to extinguish fires accompanied by the burning of gasoline or resultant gases? The extinguisher should be adapted to be carried on the machine, where it can be detached and brought into play by a by-stander even if the machine has turned turtle, and the extinguisher should be so distinctive in structure or appearance or both, as to be quickly identified and selected from the other equipment of the machine. Should the appalling loss of life from this cause continue, it would not be surprising to find the public urging the enactment of laws requiring as a life saving means, that machines be supplied with suitable or standard extinguishers as a pre-requisite to the issuance of the license to the operator.

A Long-delayed Patent.—Geo. Francis Myers, of Columbus, Ohio, is the patentee, No. 995,550, of a flying machine which has the appearance of the lower half of a sphere. It is made with a number of circular aeroplanes arranged one above the other and gradually increasing in size toward the top and a car is provided at the bottom and has a propeller for moving the machine laterally. The application on which this patent issued was filed in 1904 and is a continuation of an application filed January 29th, 1897, over fourteen years ago. We wonder what will be gained by the delay, and so will all who know something of the aerodynamics.

Pumping Snow.—Snow disposal is now considered a big problem and Cadwallader Evans, Jr., of Pittsburg, has patented, No. 995,446, a method of removing snow from city streets by which he gathers the snow in quantities, then he agitates the collected snow at the same time adding water, the mixture is then heated, bringing it to a condition in which it can be handled by pumps and he then pumps it to some suitable disposal point.

The Inventor and the Milliner.—To provide for quickly producing hats of different styles is the purpose of a patent, No. 995,990, to David Stern of New York, who provides a brim and crown and then fits a supplemental crown around the brim crown. This mounting of a separate crown around the main crown enables the use of different supplemental crowns to secure the desired effect and the two crowns can be trimmed separately which is a great convenience to the milliners.

A New Way of Operating a Vacuum Cleaner.—Operating a vacuum cleaner by the force of water discharged from an ordinary water service spigot is contemplated in a patent, No. 995,969, to Beecher W. Junk of Toledo, Ohio, who provides a main pipe to couple to the spigot and an air pipe leading to the main pipe, the ordinary vacuum cleaning tool being connected to the air pipe. He has a spiral sleeve in the water pipe which causes the water to have a whirling motion and produces an air suction up through the air pipe or hose. He thus produces a device which can be attached to a water spigot and cause the water to produce a vacuum.

Take Up Your Bed and Climb.—An article of furniture useful as a bed by night and a ladder by day is the subject of patent No. 995,430 to Jerome Arsenault and Chas. Larrivee of St. Flavie, Quebec, Canada. They make a bed whose side rails and end rails have bars and rungs between them so the bars when the bedstead is taken down, can be handily used as ladders.

Distilling by Induced Electric Currents.—A patent, No. 994,022, has been issued to the assignor of Robert J. McNitt of Niagara Falls, N. Y., for a process of distilling substances which cannot be distilled by the application of external heat on account of the destructive effect of such heat upon the walls of the distilling vessels, the process consisting in generating the required degree of heat by induced electric currents. The process appears to be especially designed for distilling alkali metals from their alloys.

Milling Grain in a New Way.—Harry M. Blinn of Baltimore, Maryland, has secured a patent, No. 993,819, for a milling process in which grain is pulverized in its entirety to reduce it to an impalpa-

LEGAL NOTICES

Classified Advertisements

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READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. There is no charge for this service. **In every case it is necessary to give the number of the inquiry.** Where manufacturers do not respond promptly the inquiry may be repeated.

MUNN & CO., Inc.

Inquiry No. 9240.—Wanted, addresses of owners of limestone beds running not less than 98 per cent, and near a railway.

Inquiry No. 9241.—Wanted, addresses of owners of deposits of molders' sand suitable for heavy castings.

Inquiry No. 9242.—Wanted, addresses of makers of bag valves.

Inquiry No. 9243.—Wanted, address of maker of Rover's monogram embossers.

Inquiry No. 9244.—Wanted, address of manufacturers making rollers, scrapers, and driers suitable for making soap leaves.

Inquiry No. 9246.—Wanted, addresses of parties having raw materials or minerals containing potash in any form.

Inquiry No. 9247.—Wanted, to buy a Parmelee aerated water.

Inquiry No. 9254.—Wanted, the name and address of manufacturers of lead pencils and pen holders, such as are used for printing advertisements on.

Inquiry No. 9255.—Wanted, to buy a patent roller, a ball-bearing axle, which could be purchased on a royalty basis; it must be clean and fully proved.

Inquiry No. 9256. Wanted addresses of parties having Pitchblende deposits, if able to ship ore.

Inquiry No. 9257. Wanted addresses of firms selling second-hand water turbines.

ble powder and branny flakes are coated with the powder thus formed, the product being a flour middlings in which is incorporated a portion of impalpable cereal powder which coats the bran in the middlings.

Driving a Moving Picture Film Frictionally.—A patent, No. 994,042, has been issued to the American Moving Picture Machine Company of New York for a film actuating mechanism including means for driving a film by frictional contact with the edges thereof, the mechanism employed including a rotatable member which is arranged frictionally to engage with the edge of the film.

Wanted: A Rivet-heating Machine.—There is considerable inventive activity along the line of pneumatic riveting machines universally used in the erection of structural steel work. There does not appear however, to be any attempt to displace the picturesque blacksmith with his portable forge high aloft, who, with unerring aim, tosses the red hot rivets into the nail keg held by the riveter, but he will pass also when some enterprising inventor devises some means of heating the rivets at the very place where they are applied (electrical heating, possibly), and it is not too much to believe that they may be brought to a riveting heat in a suitable heater and fed one by one directly to the holes formed to receive them.

A New Vacuum-cleaner.—A patent, No. 993,343, has recently been issued to P. D. Brewster of East Orange, New Jersey, for a vacuum dust collector having a pipe to carry the air and dust and a water tank, together with means for introducing water from the tank into the dust pipe together with means for producing the vacuum and separate means for drawing the water and mud from the dust pipe and delivering it into the water tank.

An Extensible Round-top Table.—Charles W. Munz of Detroit, Michigan, has secured a patent, No. 993,539, for a round-top table which can be extended. The table includes in connection with the permanent top a circumferential series of leaves for enlarging the said top in the same plane and supporting means for the extension leaves.

New Railway Truck Side Frames.—A series of patents, numbered 993,575 to 993,578, inclusive, have been issued to Edson C. Covert of New Kensington, Pa., for truck side frames for cars including, in most of the patents, the journal box in its connection with the members of the side frame, such journal box being integrally secured in some instances and removably weld-secured in another instance.

Crape and the Inventor.—A device for holding crape to a door is covered in the patent, No. 995,472, to Frank and Lambert of New York as assignee of Harry T. Loomis, also of New York. The holder is made with a back bar to be attached to the door. This back bar has forwardly projecting teeth to bite into the crape and a spiral spring is connected at one end of the back bar and extends over the crape to press it against the teeth of the back bar and hooks at its other end to the back bar.

Another Patent Dedicated to the Public.—Mr. Alonzo D. Melvin of the Bureau of Animal Industry at Washington has just obtained a patent, No. 996,025, which he has formally dedicated to the public. The patent is for a stamp for marking meat. The stamp has a rubber head carrying the inscription and provided with a flexible rubber shank made in one piece with the head and held in a socket in the end of a handle.

Why Not an Earth Tamping Machine?—Recently in passing a number of laborers ramming down the earth in a ditch which was being filled, it occurred to the writer why some machine had not been produced which could be managed by one man and operated to ram in the earth

just as it was being done by the gang of laborers. Now that gasoline motors are so adaptable, the machine could be kept ready for instant use, could be supplied with rammers limited in number only by the size of the framework and the capacity of the engine, and the engine could be utilized to move the machine from place to place as well as to operate the rammers. Of course, many problems would have to be solved, but they would doubtless yield to the skill of an ingenious inventor.

General Otis and the Patent Office.—General Harrison Gray Otis, who has gained increased notoriety through the blowing up of his newspaper plant in Los Angeles, and his controversy with organized labor, was at one time an official of the Patent Office at Washington, where he was chief of the corps of proof readers prior to the organization of the Issue and Gazette Division. General Otis was appointed to the Patent Office from Marietta, O., in May, 1871, and resigned January 31st, 1876, thus serving in the Patent Office a little less than five years.

An Implement for Cleaning Ceilings.—The cleaning and scrubbing of ceilings is frequently a difficult matter and an implement has been patented, No. 994,204, by T. A. Schoenlau of St. Louis, especially designed for the purpose. It has a funnel shape body to put up against the ceiling in which are provided rotating brushes to which a cleansing fluid is delivered to cleanse the ceiling.

A New Continuous Current Arc Lamp.—Inventions in arc lamps are nearly always interesting and along this line Max Korting of Leutzch, near Leipzig, Germany, assignor, in a patent, No. 994,261, presents a continuous current arc lamp which has a number of depositing surfaces supplied with electric potential, one of the surfaces being connected with one terminal of the lamp and one with the other terminal.

A Mechanical Sparring Partner.—Exercising devices are quite popular and a patent, No. 952,862, was issued last year for such a device in the form of a dummy or figure representing a person of normal size and mounted upon a freely rocking weighted base permitting it to swing in all directions. The body portion of the figure is suitably stuffed or inflated and the person exercising may strike it with his bare fists or may use gloves and the figure, when struck, will be caused to rock rapidly on its weighted base simulating the action of a punching bag. The weighting of the base causes the quick return of the figure after it has been struck and as the figure may move freely over the floor when struck, the user secures considerable practice in foot work as well as in striking. This sparring partner suggests the possibility of a wrestling partner and no reason is seen why a wrestling partner should not be invented which could in many ways operate to exercise the person desiring practice on the mat.

Wanted: An Automatic Grain-shocker.—In an article by W. J. Brandon, in the *American Thresherman*, the statement is made that in the grain fields there is an opening for an automatic grain-shocker, which can be sold at a reasonable price. Such a machine would be another great aid to increased efficiency. "No machine," he states, "has yet been put upon the market that shocks the grain successfully."

The Ozone Generator.—In the SCIENTIFIC AMERICAN of May 27th attention was called to the suggested necessity of an ozone generator in commercial form, adapted for what might be termed popular use. Since then, the attention of the writer has been called to the so-called ozonator made by the General Electric Company and fully described in the General Electric Review of June, 1911, in an article which includes the physical and chemical properties of ozone and a description and illustration of the device. This is said to be the practical result of years of experimentation. The device includes means for providing ozone when the current is applied a blower for forcing air through the ozone chamber and diffusing the ozone throughout the room, suitable connections insuring the running of the blower at all times when ozone is being produced. Connections for the current and for the switches for controlling the same are provided and the apparatus presents a neat, compact and business-like appearance.

Theory vs. Practice in Invention.—B was the inventor of a new machine for stoning peaches and M was a successful inventor who had made good inventions and had been able to market the same in a way to make a pronounced commercial success. B's peach stoner was a marked departure from anything that had gone before and he was proud of the practical evidence of his originality. Appreciating M's experience along the patent line, B asked him his opinion of his new invention. After careful examination M said: "Your machine is all wrong in principle, but," he added, "I made a machine for taking the stones out of peaches that was all right in principle. My machine which was all right in principle would not work in practice. Possibly your machine which is all wrong in principle will work all right in practice." I never learned whether B's machine was a practical success.

Wanted: A Humane Dog-muzzle.—The dog muzzling time is now at hand. No one questions the discomfort, if not the cruelty, of many of the muzzles now in use. Have you ever thought of the tremendous market that is ready and waiting for some one who can devise a simple, inexpensive, efficient and essentially humane muzzle? Such a muzzle would be welcomed by the dog owners and, since it could be worn without annoying the animals, would avoid the dangers resulting from the removal of the muzzle, especially after nightfall, when the guardians of the law are not so likely to observe conditions.

Legal Notes

Establishment of Trade-mark Rights.—What is sufficient initial use of a trade-mark to establish trade-mark rights is frequently questioned. The Court of Appeals of the District of Columbia in the recent case, decided April 3rd, 1911, of Bretenbach and F. H. Strong Company vs. Rosenberg, says:

"Every trade-mark must have a beginning, and it would be unreasonable and unjust to say that it must be general, and the article widely known before the trade-mark in the named affixed to it, and indicating its origin, can be acquired."

In this case, the Court of Appeals quoted with approval an opinion of the Circuit Court of Appeals of the Seventh Circuit in Malzkaffee Fabriken vs. Kneipp Med. Co., 82 Fed. Rep., 321, as follows:

"It is enough, we think, if the article with the adopted brand upon it, is actually a vendible article in the market, with the intent of the proprietor to continue its production and sale. It is not essential that its use has been long continued, or that the article should be widely known, or should have attained great reputation. The wrong done by piracy of the trade-mark, is the same in such case as in that of an article of high and general reputation and of long continued use. The difference is but one of degree and in the quantum of injury. A proprietor is entitled to protection from the time of commencing the use of the trade-mark."

The Ownership of a Trade-mark Not Originated by the Owner.—In the case of Nestle & Anglo-Swiss Condensed Milk Co. vs. Walter Baker & Co., Limited, the Court of Appeals of the District of Columbia on April 7th, 1911, reversed the decision of the Commissioner of Patents and held that where the opposer was not the originator of the trade-mark consisting of a waitress in Quaker or Puritan costume carrying a tray, such opposer has no right to exclude every one else from using the representation of a woman as a trade-mark upon goods similar to that manufactured by it.

RECENTLY PATENTED INVENTIONS.

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Pertaining to Apparel.

FLEXIBLE CONNECTION.—J. H. O'BRIEN, Ilion, N. Y. An object of this inventor is to provide a device in which a plurality of members are movable relatively to each other against the tension of a spring, the members having attached thereto flexible connections, for supporting in various manners, with a yielding tension due to the resilience of the spring.

Electrical Devices.

TELESCOPIC MAST FOR WIRELESS TELEGRAPHY, SIGNALS, AND SIMILAR USES.—A. F. JUILLAC, 25 Rue de Meaux, Paris, France. In extending the folded mast the sleeve is brought into position to allow pawls to engage the uppermost tube ferrules. The crank shaft moves the sleeve upward on the standard and elevates the said tube, which when at its highest point, the top of a second tube is clamped on its bottom by means of a rod. The sleeve is then lowered and engaged with the second tube, and when again moved upwardly, both tubes are lifted. When the second tube has reached its highest, the top of a third tube is clamped on the bottom of the second and the sleeve lowered and engaged with the bottom of the third tube. This is repeated until the mast is extended. Means provide for folding the mast.

Of Interest to Farmers.

MANURE LOADER.—A. S. STONE, Clear Lake, S. D. This invention provides a device which forms a platform or carrier for the material to be handled as the same is moved in the first instance; provides a runway or inclined rear bed to move the carrier above the body of the vehicle by which it is to be moved; provides a mechanism for moving the carrier by the incline to dump the same; and provides a mechanism simple and operable by means of the power devices convenient to farms and localities where an apparatus of this kind is employed most generally.

VARIABLE CHANGE GEAR FOR PLANTERS.—A. M. CRISMAN, Davenport, Iowa. The invention is an improvement in variable chain gear for planters' use, and the object is to provide a device of the character specified whereby the movement of the seed dropping plates of a planter may be varied so that different amounts of seed may be planted in a hill without stopping the planter.

AUTOMATIC PLANTER AND CHECK-ROWER.—A. M. CRISMAN, Davenport, Iowa. The present invention is an improvement over a prior patent granted to Mr. Crisman, and its object is to provide an automatic dropping device for depositing a predetermined number of grains in hills at equal horizontal distances from one another, regardless of inequalities of the ground, and wherein a minimum of work is imposed on the measuring wheel, the actual operation of dropping being done by the carrying wheels.

Of General Interest.

LOADER FOR CONCRETE BATCH MIXERS.—W. R. TUTTLE, Meadville, Pa. This mixer is arranged to permit accurate measuring of the quantities of materials at the time they are filled into the loader, to allow convenient charging of the loader and delivering the materials to the drum of the mixer, at the same time supplying the water in a measured quantity, thus insuring the formation of batches of concrete of uniform consistency.

METHOD OF PREPARING SCREENS FOR COLOR PHOTOGRAPHY.—L. D. DU HAURON and R. DE BERCEGOL, Joinville-le-Pont, Seine, France. It is sought in this invention to cover a transparent or translucent surface of glass celluloid, paper and the like, with a very large number of exceedingly small rectangular figures, such as bands, rectangles, lozenge-shaped figures, etc., having three distinct colors placed closely together without leaving any interval, and each covering theoretically one-third of the surface. The process is rapid and economical.

DIE.—M. E. BLUME, Leipzig, Germany. The invention relates to dies more particularly for use in stamping letters or other characters into printing metal. The aim is to provide a die so formed that the characters impressed into the metal thereby have no deleterious effect on the metal surrounding them, so that when impressing a character no lateral swelling or bulging of the metal takes place.

TOOTH FOR EXCAVATING BUCKETS.—E. L. PEMBERTON, New Haven, Conn. The object here is to provide a tooth having a detachable point, so secured to the body of the tooth that it may be reversed when desired. In practice the points usually become worn on the lower cutting surface, and it is the purpose to provide a tooth with a reversible point so that great additional wear may be obtained.

AUXILIARY DRAINING TUBE.—P. S. PLACE, Alfred, N. Y. The tube is for use in convenient insertion in a vein or artery of a human body to be embalmed, and it is arranged to permit its insertion to any depth to insure proper draining of the blood from the vein

or artery, and to allow convenient cleaning of the tube while the same is in use, with a view to keep the passage open for the blood to readily flow out.

GROUND ANCHOR.—J. SCHROEDER, Oschersleben, Germany. The purpose in this invention is to provide an anchor for removable connection with the ground and adapted to secure in place ropes, chains and the like, and the improvement is more particularly adapted to secure balloon or airship sheds, and devices pertaining thereto.

Hardware and Tools.

OIL CAN RACK.—T. MILLER, Springboro, Ohio. In the present patent the invention consists in constructing a metal skeleton rack, shaped to secure an oil can of usual construction, and a spring pressure member to bear against the side of the can to hold the same firmly against holding members on the rack.

RAZOR.—H. J. MILLER, New Orleans, La. In this instance the invention has reference to razors, and has for an object the provision of a foldable razor having a blade removable from the shank of the razor, so that a new blade can be employed to replace the worn blade, and a guard to permit of cutting the beard or the like without marring the skin.

ATTACHMENT FOR LADDERS.—E. C. MEAD, Elkhart, Ind. In this invention use is made of notched retaining bars secured to the body of the ladder, railings mounted to swing on the bars, means on the bars and adapted to be disposed in the notches of the bars for adjustably supporting the railings and the last being provided with means for supporting packages or receptacles thereon.

PIPE WRENCH.—L. F. FITZGERALD, Coalinga, Cal. This wrench is for use in handling pipes, oil well casings and the like, and more particularly to a device of this class comprising a handle, a head secured thereto and having a gripping jaw, a flexible member having one end movably secured to the handle, and means whereby the other end of the flexible member can be adjustably and removably secured to the handle.

Heating and Lighting.

ATTACHMENT FOR GAS FIXTURES.—J. H. CATO, Kansas City, Mo. This attachment is adjustable to gas fixtures, and offers a suitable support for a number of brackets carrying smoke bells at their outer ends. An object of the invention is to provide an article which is capable of adjustment on the gas fixture, so that the smoke bells may be suspended in any desired position.

Household Utilities.

KNOCKDOWN COUCH.—I. E. EMERSON, Baltimore, Md. The invention provides portions of the adjacent chair structure which may be removed from their normal position to be fitted between the adjacent chairs, locking the same in fixed position and forming, in conjunction with the seats thereof, a bed mattress; and provides chairs with complementary auxiliary sections which may be removed from the normal position to form, in conjunction with other chairs and like complementary sections thereof, a reclining structure.

Machines and Mechanical Devices.

SHEARING MACHINE.—J. F. LEAKE, Knoxville, Tenn. This invention is an improvement in shearing machines, and the object of the inventor is the provision of a simple and easily operated machine of the character specified, wherein the upper turret is moved angularly simultaneously with the lower turret, and is moved vertically with the ram toward and from the lower turret.

HORSE FEEDING MACHINE.—JOHN B. JOHNS, Fairmont, W. Va. The invention provides a machine wherein grain may be measured in bulk quantity to agree with weight; provides a machine wherefrom various quantities may be delivered, the regulator for said quantities being operated by means of selecting devices; and provides a simple and effective measuring device controlled by a simple construction to provide a variety of effects.

FEEDING ATTACHMENT FOR TYPE WRITING MACHINES.—H. M. BURCH, Atlanta, Ga. The invention relates to improvements in feeding attachments for machines for feeding envelopes, telegraph blanks, etc. An object is to provide a device in which an envelope or blank which is crimped, whose surface, therefore, is not in a single plane, may be fed through the device and with as much certainty as envelopes or blanks which are not crimped, and which, therefore, present a plane flat surface to the feeding member.

Designs.

DESIGN FOR A GLASS VESSEL.—C. F. PROSCH, Honesdale, Pa. The design in this case is representative of a wine glass or goblet, along very graceful and simple lines, the ornamentation comprising a band encircling the article near the rim, the band being decorated with a flower repeated and separated by intertwining laces.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Kindly keep your queries on separate sheets of paper when corresponding about such matters as patents, subscriptions, books, etc. This will greatly facilitate answering your questions, as in many cases they have to be referred to experts. The full name and address should be given on every sheet. No attention will be paid to unsigned queries. Full hints to correspondents are printed from time to time and will be mailed on request.

(12480) W. D. says: Astronomers state that the North Pole of the earth is inclined toward the sun 23½ degrees at the summer solstice, and the South Pole 23½ degrees at the winter solstice. They accompany this statement with a drawing purporting to show the inclination. The only proof given in support of this claim that the poles have such inclination in text-books on astronomy which I have seen is the change of the seasons. It seems clear that the change of the seasons could be accounted for on the theory that the earth's axis is parallel to the axis of the sun and that the plane of the earth's orbit intersects the plane of the sun's equator at an angle of 23½ degrees. If these conditions existed, the rays of the sun would reach 23½ degrees over the North Pole at the summer solstice and 23½ degrees over the South Pole at the winter solstice. Has it ever been mathematically demonstrated that the poles of the earth are inclined toward the sun as stated and illustrated in text-books on astronomy? Or is any proof given except the change of seasons? A. We are not able to agree with your statement that "the North Pole of the earth is inclined toward the sun 23 degrees 30 minutes," etc., since the pole is a point, and a point cannot be said to have an inclination to a line. We should say that the earth's axis is inclined to the plane of its orbit at an angle of 23 degrees 30 minutes, and this causes the northward and southward apparent motion of the sun in summer and winter, thus causing the change of seasons. Nor as a matter of fact is it the case that the sun's axis is parallel to the earth's axis, nor does the plane of the earth's orbit intersect the plane of the sun's equator at an angle of 23 degrees 30 minutes. See Young's "General Astronomy," price $3, postpaid, Article 282: "The inclination of the sun's equator to the plane of the ecliptic is 7 degrees 15 minutes; to the plane of the terrestrial equator it is 26 degrees 25 minutes. The axis of the sun is directed almost half way between Vega and the Pole Star." Two hundred years before Christ the Greeks had measured the inclination of the earth's equator to the plane of its orbit with a good degree of accuracy. It is half the difference of the altitude of the sun at noon on the day of the summer and of the winter solstice. It can be determined by the length of the shadow of a vertical pole at noon upon a level plane during a year. There is no reason for doubt that the position of the sun's equator in space is accurately known, and that of the earth's axis to the plane of its orbit. The seasons of the earth is a result of all this, but not a proof of this. Between these two there is a great difference.

(12481) W. P. says: Do you know of any material or composition of materials that the resistance will decrease or conductivity will increase, in proportion with the voltage or with the increasing of the voltage? I want to get some material that current will not pass through it at low voltage, but as the voltage increases, it will allow the current to pass through it. A. We do not know any material whose electrical resistance depends upon the voltage of the current to which it is opposed. Every conductor allows more current to pass as the voltage is increased, but this is not what you ask.

(12482) W. G. T. says: A claims that thunder and lightning are caused simultaneously by the coming together of two oppositely charged clouds. B claims that thunder *follows* lightning, in that the thunder is caused by the air rushing together to fill a vacuum which has been made by the lightning's passage through the atmosphere. Who is right? A. B is correct in holding that thunder is caused by the air rushing back into the partial vacuum created by the passage of the electric discharge and the great heating of the air in the path of the discharge. The thunder is a result following the discharge of the electric strain in the air.

(12483) W. C. H. asks: In your answers to questions will you kindly tell me the name of the brilliant star or planet high in southeastern sky which was passed by the moon on the evening of May 11th? Their distance apart was not over two to three degrees, I should judge. A. The planet whose name you request is Jupiter. You would be interested in following our monthly articles, "The Heavens in ————," published in the last issue each month for the following month. In these articles you will find the position of the visible planets given, so that you may always know where to look for them.

(12484) F. S. H. asks: Is there any method by which ordinary cuts in periodicals can be transferred to lantern slides? A. A cut in a periodical may be transferred to a glass

plate to use for a lantern slide, by the decalcomania process. Varnish the glass with a transparent varnish, and before the varnish is dry, rub the cut face downward upon the varnish. When all is dry, wet the paper and rub it off the glass carefully till all is removed and the cut is clear. If a second coat of varnish is put over the cut, probably the surface will be improved. Any such transfer will of course ruin the cut. The best way is to make a negative from the cut, and then as many lantern slide positives may be made from the negative as you desire.

(12485) C. C. asks: Please explain whether a high-wheel wagon pulls easier than a low-wheel wagon, the wagon to be pulled by a team whose traces are horizontal and the wheels not to sink in dirt. A. On a perfectly hard surface and with frictionless bearings, the size of wheels would make no difference in the tractive force. But as such conditions never exist, the high-wheel wagon has the advantage of smaller leverage of friction and surface speed of journals, and of climbing over obstructions with a more gradual lift of the wheel and axle, and less abrupt angle of force, tending to stop the wheel when meeting the obstruction. The small-wheel system offers certain constructive advantages, lighter and stronger wheels, and no very great difference in tractive resistance on hard, smooth roads. The method of making a barometer is fully described and illustrated in SUPPLEMENT No. 309, price ten cents mailed.

(12486) R. H. S. asks: I have always understood, and so taught, that the Moon revolved around the Earth once in a month, or twelve times, while we revolved around the Sun once. I saw an article that the Moon went only half way around and then returned to its starting point, and so continued. A. The Moon goes around the Earth each lunar month. It does not go half way around and then return. How could it? As well ask a base ball to stop in the air and return to the hand of the pitcher. The Moon is a heavy body in rapid motion, and cannot stop itself any more than a cannon ball can stop itself. There are however 12.4 lunar months and not 12 in a year, or the Moon goes 12.4 times around the Earth while the Earth goes once around the Sun. This causes the new Moon to fall in different parts of the month in the different months of the year.

(12487) W. C. F. writes: Construction No. 12456 by H. H. R. differs from that given in all textbooks for inscribing a regular pentagon in no essential feature. The line from C through the point of tangency passes through the center of the small circle, the radius of which is half the radius of the given circle. Therefore the distance from C to the point of tangency is equal to the greater segment of the radius of the given circle when divided into extreme and mean ratio, and hence equal to the side of the inscribed decagon. The rule might now be simply stated thus: Draw two perpendicular radii, and from the line joining the middle point of one to the extremity of the other, deduct half the radius of the given circle. The remaining segment will be the side of the decagon.

(12488) G. R. R. says: 1. How far will a 3-inch gun throw its projectiles? A. 8,500 yards (this will vary somewhat with variations in the elevation). 2. How far will a 12-inch gun throw its projectile? A. 24,000 yards (this will vary somewhat with variations in the elevation). 3. How far will the new 14-inch guns (authorized for the two new battleships) throw their projectiles? A. 21,000 yards (this will vary somewhat with variations in the elevation). 4. How long is the U. S. magazine rifle bullet in the air during its maximum flight? A. The maximum range of the U. S. magazine rifle with an elevation of 45 degrees has been computed to be 5,465 yards with a corresponding time of flight of 31.36 seconds. 5. Give the penetration, in inches, through earth for the following projectiles: United States magazine rifle; field artillery; siege guns. The penetration of a magazine rifle in loam, practically free from sand, is 18.8 inches at a range of 500 yards. Simple penetrations, normal impact, for field and siege guns have not been determined. 6. Will these projectiles penetrate greater distances of earth at long distances than at short distances? A. No; because the projectiles will have a higher velocity at short distances than at greater ones. 7. What would be the probable number of transports, largest size, required to transport an army of 200,000 men from Japan to the western coast of the United States? A. Probably 100. 8. How long would it take such a fleet to make the voyage, considering that the fleet must keep together? A. The distance of the voyage would probably be about 4,300 miles, and as the fleet would be limited in its movement by its slowest vessel, probably ten knots per hour, the distance traveled per day would probably be about 240 knots. This would be on the assumption of no interference by the enemy and no accidents or other mishaps. 9. What opinion have you on the following hypothesis: Japan, without making any declaration of intention to attack any nation, commences to embark a large army of say 200,000 men on her transports at Yokohama and Nagasaki. What action would the United States take? A. As to question 9, there is no possibility of securing any serious opinion from any service man. They will not express any opinion either officially or otherwise, except in jest, such, for instance, as "issue a call for a peace conference," "call on Carnegie," and the like.

(12489) J. C. L. asks: 1. What makes this world turn on its axis? A. We are not able to say what force produced the rotation of the earth upon its axis. Its inertia in a space in which there is no appreciable resistance maintains its rotation. 2. Name two or three of the best diamagnetic substances. A. The more strongly diamagnetic substances are bismuth, antimony, tin, and copper, although no substance is as strongly diamagnetic as the magnetic substances are magnetic. 3. How far west of the true pole is the magnetic pole? Does the needle point there from any position on the globe? A. The north magnetic pole was located by the Norwegian explorer Amundsen in 1907 in latitude 75 deg. 5 min. north and longitude 96 deg. 47 min. west. The south magnetic pole was located by Lieut. Shackelton's party in 1908 in latitude 72 deg. 25 min. south and longitude 155 deg. 16 min. east. A magnetic needle at any place on the earth places itself tangent to the lines of magnetic force at that place. It points approximately in the direction of the magnetic pole, but only approximately; but it does not point constantly in the same direction. It changes from year to year. Going down into the earth to the slight distances to which we have penetrated does not affect the magnetic needle for the reason that it is below the surface of the earth. The cause of magnetism is not known. It seems to be a permanent condition of the molecule.

(12490) E. W. F. H. asks: Will you kindly inform me through Notes and Queries how many pounds (air pressure) a cylinder of steel 1/32 inch in thickness (such as seamless tubing with heads securely fastened at both ends) 2 inches inside diameter and 8 inches long, will hold with a reasonable margin of safety? If a tank is holding 50 cubic inches of air at 500 pounds pressure, how many cubic inches of air at 25 pounds pressure are contained in tank? I figure it to be 20 times 50 cubic inches, equaling 1,000 cubic inches at 25 pounds. A. Use the formula $p\ d = 2 + s$ in which

p = pressure in pounds per square inch.
d = diameter of tube in inches.
t = thickness of tube in inches.
s = tensile strength.

Thus $p \times 2 = 2 \times 1/32 \times 60{,}000$ and $p =$ 1875 pounds per square inch. This is the bursting pressure for the cylinder if made of steel of 60,000 pounds tensile strength. You must introduce a factor of safety, which for compressed air may be 5, which gives the safe pressure as 375 pounds. Your solution of the tank problem is correct if the pressures are absolute, or pressures above vacuum. If they are gage pressures, add 15 pounds to each to convert them to absolute pressures, and solve by proportion as before.

(12491) J. P. F. asks: I have built a store room 22-foot front and 75 feet deep, ceiling 14 feet high. Front of building is all glass, with two windows in back, which gave fair light. Building is facing south, with galvanized steel awning in front. In the day time one can hardly see the goods in the show room from the outside, owing to the glare of light; cloudy days it is some better; there is no background to show window. Lit up at night by electric light shows off well through window. If there is any way of remedying the trouble you will confer a favor by helping me out. A. We are not quite clear as to the arrangement of the show window and store, but it is apparent that you need a background in the window to throw back the light on the goods behind the glass. The background need be only 4 to 5 feet high, so that light will pass over it into the store behind. If the store lighting is bad with the background in place, prism glass in the upper part of the window will project the light back sufficiently.

(12492) F. E. L. asks: Can any two or more chemicals, either liquid or dry, be brought into contact (not forcibly) and cause a quick combustion? A. There are a good many substances which take fire upon coming into contact. The end of a match and sandpaper, the safety match and the side of its box are examples. Phosphorus and iodine will ignite by mere contact without friction or pressure. 2. Are there any chemical substances which upon being exposed to the air will burn almost instantly? A. Hydrogen and chlorine gas mixed in equal parts will explode by letting the sunlight fall upon them. Impure hydrogen phosphide gives a very interesting case of spontaneous combustion when it escapes into the air. 3. Are there any chemicals which upon being exposed to certain gases burn almost instantly? A. Finely divided phosphorus will take fire almost instantly when it comes into contact with the air. These and many other chemical experiments of equal interest are described in Benedict's "Chemical Lecture Experiments," which we will send for $2 by mail. No such experiments should be attempted without special precautions against flying glass or fire, except by a person already experienced in chemical manipulations. They are not adapted to a careless amateur.

NEW BOOKS, ETC.

ENGLISH FURNITURE. By Frederick S. Robinson. London: Methuen & Co. Large 8vo.; 365 pp. 160 plates.

This sumptuous volume belongs to the connoisseur's library. The book itself is beautifully gotten up and is elaborately illustrated, although we must admit we do not like massing all of the plates at the back of the book, which would be much more usable if they were interspersed among the text; still it is almost a pity to criticise such an illuminating and informing book. English furniture at the present date supplies one of the most interesting fields for the collector, and the aim of this book is to assist those who collect or who purpose collecting. The subjects of the plates show a tendency to avoid the more common styles, but give a few of the general types with which a collector may meet. A false idea of English furniture would be formed if a majority of the plates reproduced were only such as are seldom or never found for sale but at the same time serve as examples of the skill of the old cabinet maker. Reproductions from the pattern books of Chippendale and his successors have been avoided. The book will be of great use to those who are not versed in the study of English furniture. Chippendale, Manwaring, Ince, Mayhew, Adams, Shearer; Heppelwhite, and Shearton are almost household names in this country as in England. Typographically the book is one of the best that we have seen for a long time.

THE FURNITURE OF OUR FOREFATHERS. By Esther Singleton. With critical descriptions of plates by Russell Sturgis. New York: Doubleday, Page & Co., 1908. 8vo.; 664 pp. $5 net.

There are happy hours before the old-furniture enthusiast who picks up this fine collection of plates with the accompanying text giving wonderful inventories of household goods, stories of the belongings of notable personages, and descriptions of rooms crowded with the useful and often highly ornamental chattels of vanished days. Part I, dealing with early Southern furniture, presses upon our notice a wealth of substantial pieces—oaken cabinets showing Flemish influence; walnut chairs with baluster-shaped legs and arcade-pattern backs; tables and cupboards of oak with the carvings, flutings and incised designs common to the period. There is a cradle, too, from an old Worcestershire manor house, with paneled hood and cushions of figured velvet. In later Southern furniture we are presented with examples such as William Penn's desk, a curious chair used by Thomas Jefferson while writing the Declaration of Independence, the reading desk of John Dickinson, and a library chair belonging to Benjamin Franklin, the seat of which obligingly tips to form a step-ladder. Part III concerns itself with early New England, and the imported and home-made pieces of the seventeenth century. Part IV gives us the Dutch and English periods, with church stools, warming-pans, trunks, mahogany tables and cupboards, fine examples in marquetry, chairs from the Gansevoort and Schuyler families, and hall clocks of quaint design. Part V summarizes the work of the eighteenth century, with its beaufaits, dumbwaiters, and chests of drawers. Part VI is devoted to Chippendale, and the plates show most beautiful examples in cabinets, chairs, lacquer tables, settees, and mirrors. Parts VII and VIII continue the history of furniture through the early part of the nineteenth century, and quite fulfill the expectations aroused by the foregoing sections of the work. A mere catalogue of the more striking features can not do justice to the work as a whole. It is one to be lingered over, and returned to time and again.

PEUT-ON VOLER SANS AILES? By Paul Colliard. Paris: Librairie Aëronautique, 1911. 8vo.; 109 pp.; illustrated.

Here we have exploited a new type of heavier-than-air flying-machine, designed to shift the burden of support from wings to propeller. This result is brought about by an upward inclination of the propeller shaft. The inventor names his conception the "Aerolet," and claims for it many advantages over the spread-eagle aeroplane at present in vogue. The theories and results are impressed upon us by reiteration and are even reduced to formulæ. Among other claims to superiority is that of a level landing instead of the head-on approach to earth now made necessary in bringing an aeroplane to the ground. Provision is made for safe alighting in case of engine failure, and the transverse stability of the "Aerolet" is supposed to be to a great extent automatic. The inventor is very much in earnest and writes with the sincerity of conviction.

THE WORLD WIDE ATLAS OF MODERN GEOGRAPHY, POLITICAL AND PHYSICAL. Introduction by J. Scott Keltie, L.S.D., Edinburgh and London: W. & A. K. Johnston, Ltd., 1911. Small 4to.; 128 plates and 98 page index. Price, $3.

It is astonishing to see what a very usuable atlas can be obtained for such a moderate sum. The publishers are known for the quality and accuracy of their work. The maps are clear, not overburdened with too much detail, and show every indication of being thoroughly up to date. The production of an atlas is a serious and expensive undertaking, and atlas makers of this country have much to learn from British and German map makers, particularly as regards size. This atlas is small and light in weight, but is fully as informing as many American atlases of three times the superficial area. The United States is very apt to be neglected in such foreign works of reference, but it is not in the present instance. The South American maps are especially good. British possessions all over the world are admirably treated.

LE CONSTRUCTEUR DE CERFS-VOLANTS. 1 re Serie. Cerfs-Volants simples. G. Dubouchet et J. Protche. Paris: Librairie Aéronautique. 8vo.; 24 pp.

Kite flying is one of the most ancient and honorable diversions of mankind, and the fact that the modern aeroplane partakes very much of the nature of a motor-driven kite lends new interest to an old pastime. This pamphlet is the first of a series on kite construction, and contains folders which show plans for four of the simplest kites known—the pear-shaped, the heart-shaped, the hexagonal, and the oblong. Very plain instructions accompany the drawings.

ANCIENT MYTHS IN MODERN POETS. By Helen A. Clarke. New York: Baker & Taylor Company, 1910. 12mo.; 360 pp. Price, $2 net.

A beautifully printed and most beautifully bound book, well illustrated. "The Prometheus Myth from Heslod to Shelley" and "The Moon and the Sun from the Homeric Hymns to Keats" is the full contents. The author has written "Hawthorne's Country"; "Browning's Italy"; "Browning's England"; "A Child's Guide to Mythology," and "Longfellow's Country," which show an appreciation for some of the fascinating phases of literary environment. Several of the illustrations are taken from the paintings of Max Klinger and one from Watts, both strong portrayers of the poetic side of myths. The binding is particularly handsome, showing a judicious combination of colored leaf and gold.

ENGINEERING LAW. VOL. I. THE LAW OF CONTRACT. By Alexander Haring, C.E., LL.B., LL.M. Chicago: 1911, The Myron C. Clark Publishing Company, 1910. 8vo.; 518 pp. Price, $4 net.

As is indicated by the title of this volume, the book is intended particularly for the use of engineers and engineering students. It presents a condensed text of the law of contract as applied to engineering, or rather as the law of contract has been developed in connection with cases and adjudications involving engineering subjects. The underlying principles of the law of contract are of course the same whether applied by or to the engineer, or otherwise. Consequently, the author has properly sub-divided the subject, and in each sub-division sets forth concisely and logically the principles thereunder. At the end of each sub-division are given numbers of cases exemplifying the principles and showing their application to engineering. The authors purpose in writing this volume of his work is to give the student as well as the practising engineer, an understanding of the subject sufficient to guide him in meeting the legal phases of whatever branch of engineering may be the field of his activities. As stated in the preface, the author does not believe that the case system of teaching law is the best one for engineering, and that on the other hand, the text-book method alone, does not enable the student to understand fully, how the courts work out the rules of law in connection with concrete facts. As a result, he has combined, and most judiciously, the two methods as stated above. This volume of engineering law will prove useful not only as a text-book, or for use in connection with lectures in technical schools, but also as a work of reference for the practising engineer.

THE DAWN OF MEDITERRANEAN CIVILIZATION. By Angelo Mosso. Translated by Marian C. Harrison. New York: The Baker & Taylor Company. 8vo.; 424 pp.; 203 illustrations. Price, $4 net.

The fascination of prehistory, as Prof. Mosso calls it, clings to these pages in no small degree. Things which most men would pass by as broken pottery and decaying bone are made to yield up to us a story of life in prehistoric times, telling us of the beliefs, observations, customs, and passions of bygone races, and leaving us with that feeling of renewal and regeneration which comes of contact with childhood in any form, racial or individual. In other words, far from feeling that we have made a journey into the grave, we are given a new strength and clearness of vision which comes of touching vital things. The reader accompanies the author upon his expeditions, participates in the joy of his discoveries, and follows him as he reasons back from the physical features of his find to the mental characteristics which determined them. Who can hear mention of such topics as the origin of writing, the origin of art in religion, the coloration of the body, or pre-Homeric navigation, without being at once eager to know what research teaches us of them? And when, as in the present instance, inscriptions and weapons and carvings are put before us in such profusion, and the argument from them back to their makers is so simply stated, we can not but feel something of the thrill of discovery which energizes the writer and en-

ables him to give vitality to the past through the medium of the printed page. This well-made and attractive volume is the second of a series of three, the first dealing specifically with the subject of the excavations in Crete.

THE GARDEN MONTH. Describing the appearance, color, dates of bloom, height, and cultivation of all desirable hardy herbaceous perennials for the formal or wild garden, etc. By Mabel Gabot Sedgwick, assisted by Robert Cameron. New York: Frederick A. Stokes Company. 8vo.; 516 pp.; illustrated. Price, $4.50 net.

All the scattered lore of floral catalogues, magazines, and handbooks seems to have been brought together here in most attractive and helpful form, with the addition of much that it would be hard to find elsewhere. To begin with, there is a large color-chart showing the tints of flowers and naming and numbering them, so that in the descriptive lists following the exact color of any flower may be determined by a reference from the tint number there given to the same number on the chart. Sharp half-tones are interspersed, showing the more noteworthy plants and blossoms. There are also descriptive lists of water plants, of foliage plants, of vines and climbers, and of ferns. An index of both botanical and English names furnishes ready access to any required information. In the main body of the work each page is headed with the name of a month and is divided into six columns. In the first column is the color-number of the flower, in the second its English name, in the third its botanical name. The fourth column contains a brief description of its appearance, often with a reference to an excellent illustration; the place to which it is best suited—the rock garden, the border, the ornamental bed; its mode of propagation; the soil which it requires; and other notes of interest. The fifth column gives the height to which it grows, and whether in sun or shade. The last column states the time of bloom. Many disappointments and mistakes may be avoided by a reference to this compendium. By its use in conjunction with the color-chart, the gardener may visualize his proposed color-scheme, and make sure that his floral picture, when finished, will be artistic and satisfying.

THE AUTOMOBILE. Its Selection, Care and Use. By Robert Sloss. New York: Outing Publishing Company, 1910. 12mo.; 194 pp. Price, $1.25.

Like Tennyson's brook, the stream of books designed to aid a man in choosing and running an automobile bids fair to go on forever. "What do I want to use my car for?" is the question the would-be purchaser is urged to ask himself. And upon the answer to that question, and the nature of the roads over which the car must be driven, depends the future satisfaction and comfort of the tyro in his new acquisition. The chapter on "mechanical tips" puts the reader in possession of much information that may save him from the misleading statements of agents and qualify him to judge intelligently of the attributes and possibilities of the car he is trying out. The sections on "the care of your own auto" and "driving with brains" continue to furnish knowledge that the tyro must sooner or later acquire, if not by previous study, then by hard experience. Trouble-finding and the care of tires, with the use and equipment of the car on tour and in camp, bring to a conclusion the brightly-written little treatise.

THE ELEMENTS OF GRAPHIC STATISTICS. By William Ledyard Cathcart and J. Irvin Chaffee, A. M. New York: D. Van Nostrand Company, 1910. 8vo.; 312 pp.; 159 illustrations. Price, $3 net.

"Graphic Statics" is a survey of the field of balanced forces, in which geometrical constructions are used instead of algebraic analyses. By this method it is possible to represent the magnitude, direction and point of application of a force by the length, inclination and position of a simple straight line. The gain in conciseness and ease of demonstration is apparent. After expressing the principles of graphic arithmetic, the authors turn to studies of forces and moments; the fundamental laws of tension, compression and reaction as applied to beams; roof trusses; bridge trusses; and the graphics of friction. The work is particularly addressed to students of marine engineering and naval architecture, and the principles of graphics are shown in their application to mechanism as well as to framed structures. The final section of the volume presents a series of moment diagrams for shafting, with test problems appended.

APPLIED THERMODYNAMICS FOR ENGINEERS. By William D. Ennis, M.E. New York: D. Van Nostrand Company, 1910. 8vo.; 438 pp.; 316 illustrations. Price, $4.50 net.

The contest for supremacy between the steam engine, the gas engine, and the turbine furnishes one of the most stimulating spectacles of modern progress. The advantages and drawbacks of each, with the determined efforts of engineers and inventors to increase the one and reduce the other, leads us into a competition that at least results in pushing forward the efficiency of the prime mover as a factor in the work and recreation of the world. The text-book in hand maintains that thermodynamics is neither mathematics nor logic, but physics, and hence should be presented in a middle course that proceeds from ideal operations to their modification in practice, with the development of underlying principles—stopping before these principles harden into machine design. Sound theory is given precedence over rules of practice so that the student may first acquire a confident grasp of underlying laws which will enable him to attack new problems successfully, varying his rules to meet the exigencies of the particular problem in hand. The cuts and diagrams are plentiful and clear. Problems are appended to each division of study so that their working out may lead to a perfect understanding of the preceding lesson. Chapters on compressed air and mechanical refrigeration are incorporated, and the gas producer receives its share of attention.

THE ELECTRICAL NATURE OF MATTER AND RADIOACTIVITY. By Harry C. Jones. New York: D. Van Nostrand Company, 1910. 8vo.; 210 pp. Price, $2 net.

Some years ago a series of articles appeared in the *Electrical Review*, dealing with these two correlated subjects. It is this series, revised, and with the more important of the recent discoveries added, which forms the volume in hand. The leading facts and deductions are presented in language as free as possible from mathematical terms. A popular elementary dissertation and treatment has been the aim, without any sacrifice of accuracy. There are chapters on the nature of the corpuscle and of the atom, on the radioactive substances in pitchblende and the properties of radiations, on the production of radioactive matter, and on theories and generalizations.

THE FINE ART OF FISHING. By Samuel G. Camp. New York: Outing Publishing Company, 1911. 12mo.; 177 pp. Price, $1 net.

This attractive little brochure is in essence and in name a reminder of H. P. Wells's declaration that "the angler considers his sport as a fine art, of which merely to obtain fish is a small part. . . . It is the way the thing is done." In "Fishing Kits and Equipment" the writer described the mechanical means of casting for fish. In the present papers he concerns himself rather with the approved methods of using these mechanical means. Since the methods must vary with the kind of waters fished and the kind of fish sought, the papers resolve themselves into discussions of our common game fish and their haunts, with the most approved usage in fly- and bait-casting. The numerous plates are for the most part inspirational rather than dully instructive, and a vein of catching enthusiasm runs through every chapter.

SOCIALISM. A Critical Analysis. By O. D. Skelton, Ph.D. New York: Houghton Mifflin Company, 1911. 8vo.; 329 pp. Price, $1.50 net.

In a contest inaugurated by a Chicago firm, this analysis of socialism was awarded first prize. The introductory chapter wisely refrains from any attempt at a final definition, offering instead a brief historical survey of socialistic systems past and present. The indictment against capitalism is then set forth, its exaggerations and lack of perspective pointed out, and the impossibility of a flawless order is urged. Several chapters are given over to the Marxian system—the materialistic conception of history, value and surplus value, and the law of capitalist development. The modern socialistic ideal is summarized in so far as the writer can give it form, and the socialist's attitude toward industrial and other problems is arraigned as fluid, if not vaporous. That is, the socialist refuses to submit finished plans for his ideal edifice and revolts against the tyranny of detail. The writer has at least succeeded in placing in a high light the complexity of the factors entering into the question, and his canvass is not lacking in interest, although he seems to be without personal conviction and his tentative setting forth of possibilities can hardly be dignified by the name of conclusions. As an analysis, the essay is comprehensive; as a critical estimate it is barren of results.

THE BOY SCOUTS OF THE EAGLE PATROL. By Lieut. Howard Payson. New York: Hurst & Co. 1911. 8vo.; 302 pp. Price, 50 cents.

The essential elements of the plot are provided by a trio of youthful criminals who seem to regard burglary and kidnapping as huge jokes. Their schemes are directed against the boy scouts in revenge for imaginary slights, and they are assisted in their outrages by an old reprobate who has served time in jail for smuggling. The chapters in which three of the scouts are towed out to sea by a shark, lost in a thunder squall, and almost run down by a liner, have enough adventure in them to satisfy the strongest craving. Aside from the unrelieved blackness of two of the young villians, which has been put on with rather too thick a brush, the story is well-calculated to make a host of boy friends and to inspire them with courage and a desire to learn something of woodcraft, telegraphy, and aeronautics.

VOEGEL FREMDER LANDER. Von Dr. K. Floericke. Kosmos Gesellschaft der Naturfreunde. Stuttgart: Franckh'sche Verlagshandlung.

Merchant Marine as an Auxiliary to the Navy

(Continued from page 50.)

that an adequate merchant marine can be built up by subsidies and discriminating duties jointly. With two means available of accomplishing a desired result, it is a sad commentary upon our practical statesmanship if our people cannot get together upon some measure of relief. In default of this we are guilty of deliberately perpetuating an endless procrastination, for which the foreign shipping interests are the most greatly obliged, to say the least. In the meantime, let us be prepared for the usual tirade against subsidies, accompanied by descriptions of the splendid imaginary shipping of the free-ship fallacy from anonymous newspaper articles and stuffed editorials, interposing all possible obstacles in the way of any legislation which shall wrest from the foreign shipping companies that portion of our own commerce which we must necessarily possess in order to control our own ultimate destinies.

Present Status of Cancer Research

(Continued from page 49.)

cancers and by special methods of examination peculiar bodies have been shown to exist in cancer cells, and these various parasites have been considered to be the cause of cancer. These parasites have been injected into animals in order to produce cancers, but as yet apparently no true cancers have been noted as a result of these injections. In many cases collections of new formed cells have developed, but as a rule these have not shown the distinct characteristics of a cancer, and the possibility exists that the development of a cancer in an isolated case when an animal has been injected with various micro-organisms may possibly be due to the spontaneous development of cancer independent of the injection of the micro-organisms.

As to the possible influence of pure chemical or physical factors upon the development of cancer or the growth of cancer cells, we possess certain observations. Thus it has been shown that the activity of inoculated cancers may be experimentally increased or decreased by the action of these agencies. When tumors are heated for various lengths of time their power of growth is diminished. When they are subjected to a constant irritant, the power of growth is increased. In a similar manner the action of certain chemicals may decrease the activity of proliferation of cancer cells; on the other hand in animals fed with certain substances the rapidity of growth of inoculated cancers is increased. In this respect the conditions influencing the growth of cancers are similar to those which act in the case of normal tissue, and it is being recognized more and more that the study of normal tissue growth will throw light on the questions of cancer growth, and that a study of cancer growth may clear some of the questions of tissue growth.

That chemical stimuli may influence the proliferation of normal cells has been shown in certain cases. Thus when certain chemicals were injected under the skin of rabbits it was noted that the cells of the skin took on an increased power of growth, thus were stimulated by these chemicals. However, it has not been possible to produce a cancer by this means.

Distinctly suggestive are the results of experiments which have shown that under certain conditions, namely, when certain tissues had been sensitized or prepared by being acted upon by specific substances found within the body, the action of a mechanical stimulus was sufficient to cause these sensitized cells to proliferate rapidly. While in these cases a true cancer was not formed, since all growth ceased after a certain period of time, we have at least the experimental evidence that under certain conditions sensitization may so influence cells as to cause after the action of a mechanical stimulus a marked increase in their proliferative power.

The study of cancer in lower animals has given great opportunity to test various methods for either curing or preventing cancer. As yet no method to cure cancer has been found. Neither treatment with drugs nor serum (especially prepared in order to destroy cancer cells) nor with so-called vaccines[1] has been able to check the growth of a cancer when once it has started to grow.

On the other hand definite results have bee. obtained as regards rendering animals resistant to cancer. In animals in which a cancer has been inoculated, it is occasionally noted that the implanted cancer grows for a short period of time, but later becomes smaller and disappears. When such animals are inoculated with cancer a second time, in the majority of cases the cancer cells do not grow, such animals are said to be immune or resistant to cancer. It may, however, be noted that occasionally when these animals are inoculated a third or a fourth time, the cancer may grow so that apparently this resistance to cancer is not absolute in every case.

Furthermore in certain cases when relatively large quantities of cancer material were injected, and did not grow, many of the animals so injected were resistant to a second inoculation of cancer material. It has likewise been noted that where normal tissues of mice, such as liver, spleen and blood cells were injected into other mice, the subsequent inoculation of cancer cells does not lead to the formation of a cancer.

It has also been shown that when animals are treated with cancer cells whose activity has been lessened by experimental means, that these animals became under certain conditions resistant to a second inoculation of cancer, so that no growth results.

It may be noted that in every one of the instances cited above, living cells have been used in order to render the animals immune to cancer. The inoculation of dead cells apparently cannot lead to the immunization against cancer.

The knowledge that a previous inoculation of animals with either cancer material or normal cells caused such animals to become resistant to cancer led to attempts to cure cancer in human beings by similar methods. Cancer cells which had been ground to a very fine pulp were injected into persons suffering with cancer; in a few cases the results of such injections appear to have been beneficial, but from the data on hand at present it seems doubtful that this treatment is curative.

Various investigators who adhere to the belief that cancer is caused by micro-organisms have advanced other methods for treating cancer. Thus sera have been prepared which were intended to destroy the parasites or neutralize their poisons. These sera have been used in treating animals suffering with cancer. Other investigators have attempted to cure cancer by injecting the dead organisms which they have considered to be the cause of cancer. The consensus of opinion as regards these methods of treatment is that they are scarcely likely to prove successful, for, if cancer be due to a parasite, we have still to discover what that parasite may be.

It may be stated that in various animals which have been inoculated with cancer and in which the cancer grows for a short time but later disappears[2], it has not been possible to demonstrate any substance in the blood which would delay or prevent the growth of cancer in another animal. This absence of an anti-cancerous substance in the blood of animals which have recovered from cancer would appear to differentiate cancer from the most of the diseases caused by micro-organisms; for in most infectious diseases one finds in the blood of individuals who have recovered from an attack, substances which either prevent or minimize the severity of a second attack or which destroy the organism causing the disease. Therefore it would appear that the cure of cancer will not be found by pursuing the same lines of research as were and are being followed in seeking cures for the diseases caused by micro-organisms.

In considering the various treatments of cancer which have been tried within the last few years, at least a passing word must be said anent the use of the X-ray

[1] The vaccines used in treating cancer are analogous to small-pox vaccine, and are composed of substances extracted from cancer cells, or of cancer cells whose power of growth has been experimentally weakened.

[2] There is a distinct difference between inoculated cancer and spontaneous cancer; a certain percentage of cases of inoculated cancers show this retrogression; spontaneous cancers, however, very rarely retrogress.

and radium. Both of these have been tested upon human beings, and upon animals, and although in a few cases they appear to have cured cancers, it is evident that in the majority of cases they are not effective. Their action depends upon certain rays of light which kill the cancer cells, and while they frequently are effective in destroying such cancers as originate from cells of the skin, which are superficial and accessible to these rays, naturally these rays cannot penetrate and destroy cells of cancers which are within the body.

In a certain small number of cases of cancer in human beings it has been noted that the tumor ceases to increase in size, then grows smaller and finally disappears. In one such case, following the spontaneous cure of a cancer in the abdomen, there developed in the peritoneal cavity a collection of fluid similar in character to the collection of fluid noted in kidney or heart disease. This fluid was withdrawn from the abdomen of the cured individual and was injected into persons suffering with cancer (it was hoped that this fluid might contain anti-cancerous substances). While in some cases the injection of this fluid seems to have benefited the patients, it does not seem probable that this method of treatment will prove to be of curative value.

Modern experimental investigation has therefore not as yet shown the cause of cancer. It has, however, definitely shown that the problem of cancer is intimately related to the problem of cell growth, and it is along this line that future work must be directed. As to whether the primary cause of cancer be a micro-organism or whether we must look to some change in the nature and function of the cell itself for the explanation of the origin of cancer, we are not in a position to state.

Nor has any successful treatment for cancer as yet been found. The use of specially prepared sera containing anti-substances which either destroy the cancer cells or the parasites which are supposed to be the primary cause of cancer has not been successful. Nor has the use of various chemical substances or various kinds of light rays.

However, within the next decade our knowledge of cancer should be largely increased. At present there are in the United States five laboratories or funds which are working especially in the search for knowledge regarding cancer; thus at Harvard University there is a department for cancer research, at Buffalo there is the State Cancer Laboratory, at Columbia University special work is being pursued under the auspices of the Crocker Cancer Fund. At Cornell University Medical School also a special fund exists. In St. Louis the Department of Pathology of the Barnard Free Skin and Cancer Hospital is concerned almost entirely with investigative work along the lines of cancer research. At the Rockefeller Institute also cancer research is done.

In England under the Imperial Cancer Research Fund, which has large means at its disposal, experimental and statistical work is conducted. In Berlin there are two special institutes for cancer research. In Heidelberg, in Moscow, and at the Pasteur Institute in Paris, work is being conducted. Besides the investigators working in these special laboratories, there are many individual investigators both in this country and abroad who devote much or all of their time to this subject. In addition to these laboratories there are several hospitals, in some cases connected with the laboratories, which treat only cancerous cases.

Now that the fight against tuberculosis is well established both in lines of scientific research and in efforts toward public education and that it is generally recognized that scientific research will gradually add to our already acquired knowledge of how to control and cure the various infectious diseases, there still remains the crying need for support for investigative work in the lines of cancer research. For cancer is certainly one of the diseases which human beings have most to fear both on account of the inability to cure (except by early excisions) and the frequent occurrence of this disease. The endowments and financial means at the disposal of these laboratories mentioned above varies considerably, but the fewest of them have really ample means to carry on the work on such a scale as it should be carried. It will only be by placing sufficient means at the disposal of the various investigators that we may hasten the eventual success of the research as regards the cause and cure of cancer.

Weather Insurance

INSURANCE against bad weather is just now the subject of much discussion, *pro* and *con.*, in the English newspapers and scientific journals. Two articles on this question appear in the April number of *Symon's Meteorological Magazine.* Dr. Mill, the editor, quotes from *The Times* the prospectus of the Excess Insurance Company, Limited, which offers four forms of rain insurance policy, known as Pluvius "A," "B," "C," and "D." The first provides for compensation in case within a specified week there are more than two days on which rain falls to the amount of over 0.20 inch. The premium is one-eight of the weekly compensation; thus, £1 per week premium would bring £8, in case the limit of rainfall was exceeded within the week. Pluvius B provides for payment for every day on which the rainfall exceeds 0.20 inch, and the premium per week is one and one-half times the compensation payable per day. Pluvius C takes account of smaller falls of rain, and offers compensation for the second and each additional "rain day" (a day with 0.01 or more of rain) in every separate week having a total rainfall exceeding 0.15 inch. The premium per week is equal to the amount payable per day. Pluvius D provides for four consecutive days, and under it payment will be made for every day on which the rainfall exceeds 0.20 inch. The premium for four days is equal to the compensation to be paid per day. Proposals for policies A, B and C must be made at least seven days, and for policy D at least two days before the period begins.

It is pointed out in one of the articles referred to that the term "compensation" is inappropriately applied to the money that the company will be required to pay in the event of a certain contingency that may not involve a loss, pecuniary or otherwise, to the insured. A man residing in London, for instance, may take out insurance against the occurrence of rain at Liverpool during a certain week, though he may have no intention of visiting the latter place and the rain that may fall there may in no way affect him. In this case the transaction becomes a pure gamble. Supposing, however, that the policyholder is really seeking to indemnify himself for a spoiled holiday—or for the loss of gate-receipts at some out-of-door entertainment of which he is the promoter—the vagaries of a rainstorm may defeat the best intentions of both insurer and insured. The policy provides that, within a certain district, the readings of a specified raingage shall determine whether the company is liable for the amount of the policy. However, rain is often so local a phenomenon that the gage may record a heavy shower when the policyholder, a few miles or even a few rods away, may not experience a sprinkle. In this case he collects his insurance though he has suffered no damage. On the other hand, he may get a drenching from a local storm that does not contribute a drop of water to the gage; thus suffering damage for which he is entitled to no compensation. This is but one of the elements of uncertainty that enter into the question. the plan assumes, for example, a much higher degree of accuracy in rainfall measurement than should be expected of the average observer. If the total rainfall up to the moment of observation is near to the critical amount, the observer's personal equation may easily vitiate the result. A rain gage is rarely read exactly at the nominal time of observation; and a deviation therefrom of a minute or two, if heavy rain is in progress at the time, might throw the measurement one side or other of the critical value. Even the question of disposing of the third decimal, where the gage is read to the thousandth of an inch—a matter of no importance from a scientific point of view—might involve the loss of

CONSERVATION

The AUGUST MAGAZINE NUMBER of the SCIENTIFIC AMERICAN

ISSUE OF AUGUST 12th, 1911

"The average American family throws out of the back door enough food to feed an average family in Europe." Yes—you have heard that before—so often have you heard it that you are weary of the repetition. Yet your ear is not half so tired of the sound as your heart should be sick of the fact. We are an amazingly wasteful race. Our garbage-pail and waste-basket, full as they are to overflowing, have grown to a size which is a national reproach. Our "dime" is the "penny" of those older races that have learned the lesson of thrift under the lash of poverty—our "dollar" is their "shilling"; our "millionaire" their man of "modest fortune."

The next magazine number of the Scientific American, August 12th, 1911, will contain a series of articles by leading authorities, which will deal with this vital subject of the conservation of our natural resources.

Ex-Chief Forester the Hon. Gifford Pinchot, whose earnest fight for the preservation of the coal lands of Alaska has led to a favorable decision of the Land Office, which greatly strengthened the cause of conservation, will open the number with an article on the Conservation of our Forests.

The Director and Chief Engineer of the Reclamation Service, F. H. Newell, will write a general article on the past work and future plans of the Reclamation Service. In its freedom from political interference and the high professional character of its personnel, and in the permanent nature of its engineering work, this branch of our national conservation is deserving of the highest praise. Mr. Newell's article will be supplemented by several others written by the Resident Engineers in charge of the principal projects.

The Director of the Bureau of Mines, Dr. Joseph A. Holmes, will show that the waste of our supplies of coal is due not merely to careless and extravagant management in the mining of the coal, but also and very largely to methods in burning the fuel. Poorly designed furnaces and badly constructed smoke-stacks, which inevitably result in excessive smoke production, are answerable for much needless waste of coal.

Dr. David T. Day, of the United States Geological Survey, will prove, in an article on the conservation of oil and gas, that, as with coal, so with oil and gas, it is possible to effect large economies by judicious management in the oil and natural gas fields and by the use of improved appliances in burning these fuels either for light or power purposes.

Dr. Hugh M. Smith, Deputy Commissioner of Fisheries, will contribute an article on the Conservation of Fish, Oysters, etc., and Seals. Conservation is a word to which we are liable to give too restricted an application. We are apt to think in terms of forests, mines and other resources strictly related to the land, forgetting that the food supplies in the seas and rivers are subject to as ruthless a waste and call for as careful a conservation as any of the resources of *terra firma*.

In addition to the above articles, the August 12th number will contain the usual Editorial, Aviation, and other Departments.

thousands of dollars to the insurer or the insured.

To the meteorologist the whole scheme appears to border on pure speculation, and not to be reducible to the scientific character of ordinary forms of insurance. There does not appear to be any attempt, even, to take into account the geographical and seasonal distribution of rainfall. The projects of this character thus far put forth apparently assume that the risk is the same whether the place covered by the insurance has a mean annual rainfall of 25 inches or 50 inches, and whether the period in question falls at a time of year that is usually dry or the reverse.

The complications involved in formulating a really equitable scheme of insurance against rain are so numerous that no actuary having a moderate knowledge of meteorology would think of trying to solve the problem.

Dreams That Came True

A PROVERB, which by constant reiteration has become somewhat musty, tells us that "Truth is stranger than fiction," and we have constant evidence of this outstripping of romance by reality. It is not so generally known that romance has often anticipated sober fact; but such is the case. In the present article it is proposed to enumerate a few instances which appear to be of unusual interest.

In the year 1869 the Suez Canal, one of the most important engineering enterprises ever undertaken, was opened to the world's traffic. It was foreshadowed as long ago as the sixteenth century by Christopher Marlowe, one of the early English poets, in the following lines:

"Thence marched I into Egypt and Arabia,
And here, not far from Alexandria,
Whereat the Terrene and the Red Sea meet,
Being distant less than full a hundred leagues,
I meant to cut a channel to them both,
That men might quickly sail to India."

It may be urged with reference to this quotation that so soon as it became possible to make an approximately correct chart of the world the advantage of cutting through the Isthmus must have been apparent to many, and that Marlowe merely reflected the thought of others. This, of course, is likely to be the case; but no such plea can be urged against the very curious anticipation of wireless telegraphy by Strada, the Italian historian, who was born at Rome in the year 1572. Addison quotes Strada in one of his noted essays; but we need hardly say that in doing so he had no notion of any anticipation of the electric telegraph, for Addison died just a century before communication by that means became possible. Addison writes thus:

"Strada, in one of his prolusions, gives an account of a chimerical correspondence between two friends by the help of a certain lodestone which had such virtue in it that if it touched two several needles when one of the needles so touched began to move, the other, though at never so great a distance, moved at the same time and in the same manner. He tells us that two friends, being each of them possessed of one of these needles, made a kind of dial-plate, inscribing it with the four-and-twenty letters, and in the same manner as the hours of the day are marked on the ordinary dial-plate. They then fixed one of the needles on each of these plates in such a manner that it could move round without impediment so as to touch any of the four-and-twenty letters. Upon their separating from one another into distant countries, they agreed to withdraw themselves punctually into their closets at a certain hour of the day, and to converse with one another by means of this, their invention. . . . By this means they talked together across a whole continent, and conveyed their thoughts to one another in an instant over cities and mountains, seas or deserts."

It will be seen how close is the description of this dial instrument to the A B C telegraph of Wheatstone which, until it was superseded by the telegraph, was in common use in many offices. But as there is no mention of any conducting wires between the two friends in communication, we are justified in regarding this as being prophetical of the more recent invention of Marconi.

Roger Bacon (1214-94) may have foreseen the possibility of making dynamite and other powerful explosives when he wrote the following words:

"A small portion of matter, about the size of the thumb, properly disposed, will make a tremendous sound and coruscation, by which cities and armies might be destroyed." But he does not go so far as to hint that it would ever become possible to throw small parcels of explosive matter upon a doomed place from a distance of seven miles or more, a terrible example of the power of propellants which was witnessed in the war in the Far East.

The torpedo was very well described by Ben Jonson three hundred years ago, as the following bit of dialogue, taken from his "Staple of News," produced in 1625, will show:

"Barber: They write here of one Cornelius-son hath made the Hollanders an invisible eel to swim the haven at Dunkirk and sink all the shipping there.

"Pennyboy: But how is't done?

"Cymbal: I'll show you, sir. It is an automon, runs under water, with a smug nose, and has a nimble tail made like an auger, with which tail she wriggles betwixt the costs (ribs) of a ship and sinks it straight.

"Pennyboy: A most brave device to murder their flat bottoms."

No doubt, however, can be entertained regarding the reality of the various devices described and illustrated in the work by Hero of Alexandria, who flourished about 100 B. C. In this book may be found the prototype of the steam turbine, the form of engine that has come to the front within the last few years.

Turning over the pages of Hero's work, we are reminded that the slot machines which seem to us moderns such a new way of dispensing small articles are by no means new in principle. Here a machine is described and figured which is provided with a slot, the dropping of a coin within which will cause a measured quantity of the liquid to flow out.

It has been contended that a strange foreshadowing of the X-rays is to be found in a book by Dr. Andrew Blair, entitled "Annals of the Twenty-ninth Century." The date of the work is not given, but the prediction, if it may be called such, runs as follows:

"I perceived the Secundines could not only make glass and stones and all inorganic substances malleable, but possessed a power undreamed of by man of making them transparent. I was shown animals upon which the youths were taught zoology and comparative anatomy, in some of which the skin was like a glass case showing beneath the working of the muscles. In others the skin and muscles were pellucid, showing the circulatory system. In others all was perspicuous save the bones, with the view of their being subservient to the study of osteology."

When the X-rays were first detected by Prof. Röntgen by their action upon a fluorescent screen and upon a photographic dry plate, the newspaper scribes gave the discovery the erroneous title "the new photography," quite ignorant of the fact that the dry plate was no more than a recorder of the phenomenon. Strangely enough, what we may call the "old photography," by which is meant the usual process with camera and lens, was the subject of prophecy many years ago. This is perhaps not so remarkable as the instances of prediction already given; for although the invention of the *camera obscura* is commonly attributed to Baptista Porta in the sixteenth century, its principle was well understood many hundred years before his time. And we may feel confident that many must have dreamed of the possibility of making the images formed by the sun take a more permanent form. Especially would this be the case after Scheele, the Swedish chemist, had shown in the eighteenth century that silver chloride would darken under the action of light. La Fontaine, who died long before Scheele was born, gives in one of his fables a method of picture-making which may be regarded as foreshadowing the beautiful art that is now of service to mankind in so many different ways. It occurs under the title "Voyage Supposé," and a description runs as follows:

"There was no painter in that country; but if anybody wished to have the portrait of a friend, of a picture, a beautiful landscape, or of any other object, water was placed in great basins of gold or silver, and then the object desired to be painted was placed in front of that water. After a while the water froze and became a glass mirror, on which an ineffaceable image remained."

Welding vs. Soldering

By Charles Keyes

IN following the simple law of physics, that a thin piece of metal will melt sooner than a thicker one, we have the solution of welding metals of the same degree of purity. In making a ring or band, for example, after approximating the divided ends, place in the joint a piece of the same metal, very much thinner—the thickness or thinness to be decided according to the relative states, the piece usually being about one-eighth or one-twelfth the thickness of the piece to be soldered or welded. The thin piece should be placed in the joint so that it projects on the upper or outer side slightly more than on the inner or under side and also extends beyond the joint all around. After the pieces have been properly fluxed, they should be heated—better by a blow-pipe. Care should be taken that they be heated all together, not projecting the flame upon the thin piece until the whole is heated almost to melting point.

This method is especially useful for dentists in crown and bridge work, and it may also be applied in many arts and industries, such as making brass and wrought iron pipes, etc.

In dentistry, for instance, in soldering the cap to the band, in making a crown, if an abutment, use a piece of gold one-half the thickness of the band, letting it project around the edge of the band—the circumference being about one-sixth larger than that of the band—then press it down to fit perfectly, having fluxed it beforehand, and follow the edge all the way around with the blow-pipe until it melts.

In soldering a cap on an ordinary gold crown, after the band and cap are fitted accurately, place on one side a small piece of, say number sixty, gold foil; flux well, see that its position is correct, then direct the blow-pipe on the piece of projecting foil until the joint is fastened. Thus you will have the two parts accurately adjusted and fixed. Now take another piece of, say number sixty, foil, large enough to project about one-sixth of its size around the circumference of the crown, cut out a little piece from the center, slip it between the band and crown, cutting out enough to fit accurately around the part attached; flux well, adjust the cap and band, and proceed as in the previous instance. The many applications this may have in jewelry work will be readily understood.

In brass, or the noble metals, the procedure is much the same. In welding iron, the process is very similar also. For instance, in mending a cracked cast iron cylinder, saw the crack, or file it, to its full extent, making the crack not too wide, then fit accurately a clean piece of thin wrought iron sheet in the joint, allowing it to project beyond all the extent of the crack in the same proportion as in the gold work. Heat well, and with the arc melt it to its place.

From the above one may see the many uses this method may have, each industry working out its own application.

Starch Without Photosynthesis

PLANTS containing the green coloring matter characteristic of grass and leaves obtain their carbon food by the process of decomposing the carbon-dioxide of the air and recombining the carbon with the elements of water into sugars and starches. It has been supposed that all starch is a product of this photosynthetic process. L. Cailletet reported to the Academy of Science of Paris the results of some experiments which would indicate that green plants are capable of utilizing as a source of carbon the remains of plant and animal tissues usually found in the soil. His experiments were conducted with ferns of the genus *Adiantum* and consisted in growing specimens in clean quartz sand

and others in normal soil. He found that the fern could utilize now the carbon of the air and at other times the carbon of the soil or both simultaneously. The variation seemed to depend chiefly on the intensity of the illumination. Specimens in the sand supplied with suitable inorganic food and water did not grow under conditions of lighting identical with those that normally obtain in the plant's natural habitat; under the same conditions the specimens in soil containing organic debris grew very rapidly. With stronger illumination there is more dependence upon atmospheric carbon.

Influence of Manganese on Fermentation

AT a recent meeting of the Academy of Science of Paris, E. Kayser reported some interesting experiments with extracts of beer yeast. He had previously found that the presence of manganese salts exercised a favorable action upon the alcoholic fermentation of brewer's yeast increasing the yield of alcohol. He has now tried similar experiments with the juices of the yeast obtained by drying, pulverizing and extracting. He used phosphates and nitrates of manganese and potassium in comparative fermentations and found constant differences in favor of the manganese.

Important factors in determining the activity of the extract are the temperature of the maceration and the condition of the yeast at the time of drying. For example, yeast that had been allowed to stand for some time gave juices of variable activity; the best results were obtained from yeasts that had stood from 35 to 40 hours in about 77 deg. F. Such yeasts macerated in three parts of water gave juices which, when mixed after filtering with 60 per cent of their weight of sugar, liberated gas within five minutes.

A Scientist's "Who's Who"

THE need of a book of reference containing the names, appointments and achievements of the world's foremost scientists has long been felt in learned circles. Messrs. J. & A. Churchill have in preparation a new annual which is designed to meet this want. It will be called "Who's Who in Science" and is to be edited by Mr. H. H. Stephenson.

Schedules are now being addressed to the scientists whose names may appear, and it is hoped that they will assist the publication by filling in and returning the forms to 7, Great Marlborough Street, London, W., as soon as possible.

For enabling scientists to communicate with each other all the world over, and for giving a rapid summary of the achievements and careers of great men the new annual should prove itself indispensable.

Writing to the publishers, Sir E. Ray Lankester, K. C. B., F. R. S., says: "I feel sure that your new publication will be a great convenience to all who are engaged in scientific work and in literature connected with it. I wish you every success in this new enterprise."

Variations of Alpine Glaciers

THE curves of variation of glaciers which are collected in the Alpine Museum in Berne show, according to Prof. Brueckner, that the 26 great glaciers of Switzerland which were very extensive at the beginning of the 19th century, thereafter receded at first slowly and then more rapidly, until the close of the century. The course of recession was interrupted, about the middle of the century, by a brief advance, in which only two glaciers exceeded the limits that bounded them at the commencement of the century. The glaciers showed a second slight advance between 1890 and 1895.

Although the curves of the various glaciers are similar in general, each exhibits well marked peculiarities, which make it difficult to trace any connection between climatic changes and fluctuations in glaciation. The problem of the glaciers is still involved in obscurity and much patient research will be required to effect its solution.

Science

Detecting Fire Damp by Miners' Safety Lamps.—At the recent soirée of the Royal Society Sir Henry Cunynghame and Prof. Cadman exhibited a contrivance fitted to miners' safety lamps for the detection of fire damp. The contrivance consists of a small piece of asbestos soaked in carbonate of soda, which can, at will, be introduced into the flame of the lamp without the necessity of lowering it. The presence of small percentages of gas is immediately indicated by the appearance of an orange-colored cap of the same character as appears when a wire, charged with soda, is introduced into a Bunsen gas flame.

Life-rings on a Mountain.—An extraordinary example of the way in which a mountain may afford on a small scale an image of the earth's climates, arranged in successively higher circles, has been found in the San Francisco peaks. These ancient volcanoes rise out of a plateau having a mean elevation of 7,000 feet above sea level. The peaks are encircled with zones of vegetation, which run almost like contour lines around them. Between 6,500 and 8,500 feet the yellow pine is the dominant tree. From 8,500 to 10,300 feet the Douglas fir, the silver fir, the cork fir, and the aspen share the available ground. Between 10,300 and 11,500 feet the Engelmann spruce and the fox-tail pine take possession, and ascend to the tree limit.

Radium in Medicine.—According to experiments made by Prof. Danne, of Mme. Curie's laboratory, and other scientists, radium can be introduced into the tissues by what resembles an electrolytic method. Rabbits and cows, also persons, were operated on, and the radium passed into the tissues without injury to the skin. The penetration is independent of the blood circulation and goes in to some depth, and the effect lasts for quite a time, so that cures can be made in this way. Some of the curative effects of the radium were quite remarkable, as was brought out by Dr. Haret at a recent meeting of the Academie des Sciences.

Vulcanological Studies in Naples.—The Italian government has appointed Prof. Giuseppe Mercalli director of the Vesuvius Observatory, and has granted him the sum of $10,000 to rehabilitate the equipment of that institution. At the death of Prof. Matteucci, the late director, it was found that the *matériel* of the observatory had fallen into a deplorable state of inefficiency; hardly an instrument was in working order. The importance of this institution is likely to be overshadowed shortly by the establishment in Naples of an International Institute of Vulcanology. This project, which was originated by Dr. Immanuel Friedländer, and which had the hearty indorsement of the recent international geological congress at Stockholm, contemplates an original outlay of $300,000, and an annual expense of $10,000. A good start has been made toward securing the necessary subscriptions.

The International Congress of Applied Chemistry.—President Taft has appointed the official representatives of the government on the organizing committee of the International Congress of Applied Chemistry. The representative from the Patent Office is Dr. George S. Ely of the chemical division. The Eighth International Congress of Applied Chemistry will hold its opening meeting in Washington September 4th, 1912, and other meetings, business and scientific, will be held in New York beginning Friday, September 6th, 1912, and ending Friday, September 13th, 1912. The Congress will meet in the United States in response to an invitation extended by the President by authority of a joint resolution of Congress on March 4th, 1909, at the instance of the representation of more than four thousand American chemists, the invitation being extended to the Seventh International Congress in London June 2nd, 1909, by the Hon. Whitelaw Reid, ambassador. The official representation appointed by the President includes also Dr. H. W. Wiley of the Bureau of Chemistry; Dr. C. F. Langworthy of the Office of Experiment Stations of the Agricultural Department, and other well-known scientists of Washington city.

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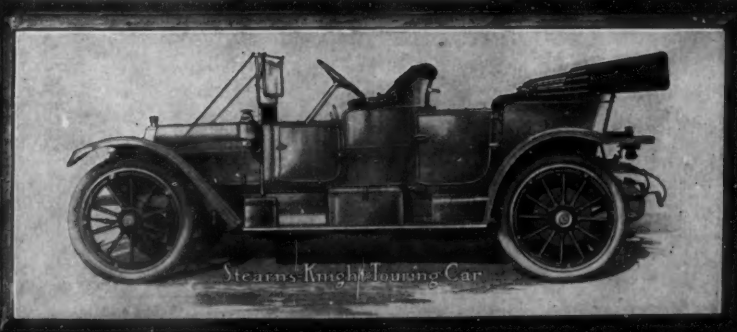

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